agriculture

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Agriculture

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The Electro-Agricultural Centre for all advisers

This Centre is a permanent part of the National Agricultural Centre at Stoneleigh. It affords a display of fundamental techniques in the use of electricity in agriculture, as well as providing conference and training facilities. In addition, there is a technical and product information library, and adequate provision for demonstrating new equipment.
This Centre has been established by the Electricity Council to help all concerned keep up to date with the latest electrical developments in agriculture. It operates in conjunction with the Demonstration Areas of the N.A.C. where electrical methods are widely demonstrated as part of the many new farming techniques.
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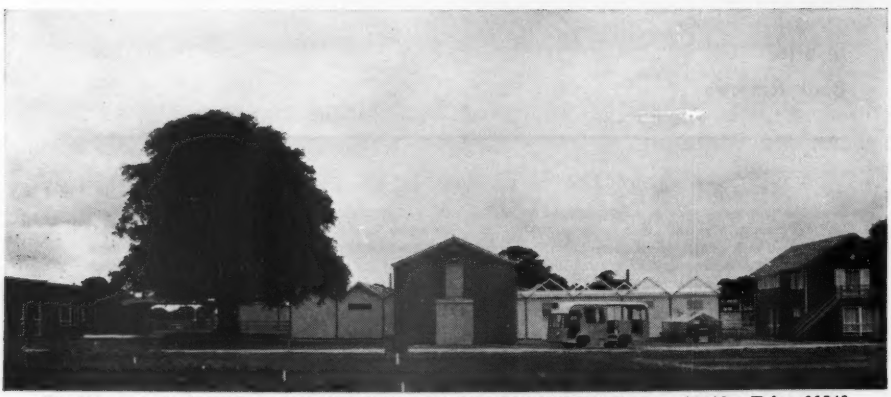

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Individual crops meet up to produce a single, consistent sample for market

Agricultural Co-operation

The author, J. M. Ewing, discusses the recent developments in agricultural co-operation

OVER the last decade, very considerable changes have taken place in the field of agricultural co-operation. There has been a steady increase in the number of co-operative organizations with perhaps the development of producer-buying groups having attracted the greater amount of publicity.

In the main, *buying groups* have relied on the attractiveness of price reduction to serve as their discipline, and few would deny their effectiveness. The fact that requisite prices quoted to producers outside these groups frequently vary little from group prices serve to demonstrate the positive impact that such groups have made.

Turning to the *marketing* sphere, one finds that very considerable advances have been made, and a wide range of commodities are now presented to the market through the agency of farmers' co-operative organizations. Markets have been extended to include processors, chain stores and brokers along with the more traditional merchants and markets. It is significant that with most commodities the aim has been to utilize the existing trade facilities and expertise.

Group approach

The group approach to marketing has opened new markets which were previously denied to the individual. Chain stores, processors and the like need quantity supplies, continuity of that supply and demand a consistent quality. These requirements can and are being met by producer marketing organizations to the benefit of both parties. An added feature of this grouping, particularly where a specific product is handled, is that it frequently widens the market opportunities through the bulking of parts of the crop which often had to be regarded as waste on the individual unit.

Changes in the more traditional outlets have also appeared in the desire to handle a reliable and well-presented product, and this in turn has given impetus to collective marketing.

Groups are now active in most commodity fields and advances have been greater in some sectors than in others. Thus, we have seen a considerable growth in the number of pig, cattle and horticultural groups, these organizations being the stronger both numerically and in terms of turn-over. Development has been less marked in the cereal and pulse fields.

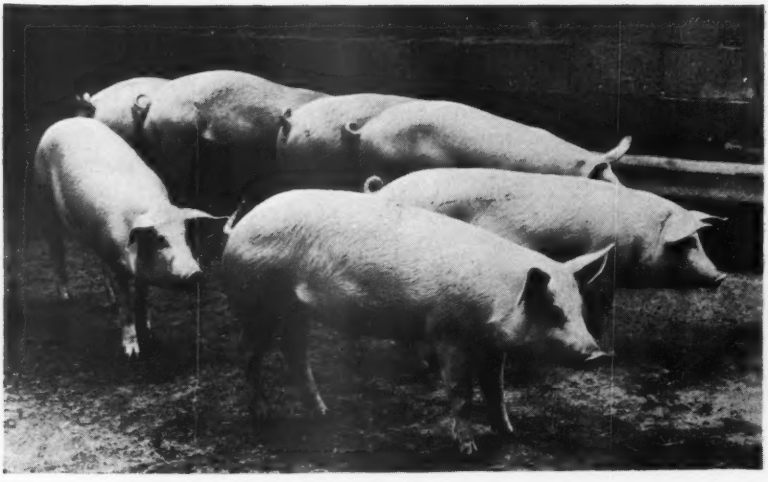
With the development of producer marketing organizations has come a need for a change in attitude to discipline and organization from that prevailing within buying groups. The introduction of contracts and the underlying need to ensure regular supplies to newly won outlets has prompted many groups to seek 100 per cent commitment of a producer's product through his organization. Indeed, the nature of the market and the product frequently demands that this discipline be extended over a period of years.

This enforced loyalty has added significance where the marketing organization involves capital investment. Uncertainty in commodity throughput can readily put such a project in jeopardy and may do irreparable damage to the participants and the project concept. The requirement for capital in the form of buildings and equipment depends on whether or not a degree of preparation for the market is necessary or whether a crop is stored before being marketed and is also related to the facilities available on the members' farms. We, therefore, find a number of potato marketing organizations acquiring dressing plant and equipment while on the other hand cereal groups may be able to market effectively by utilizing existing farm facilities.

Production methods

The move towards co-operative marketing has not been without its impact in the *production* field, both indirectly and directly. The need to meet market specifications and ever-increasing costs have meant that a new look be taken at production methods. Grouping in the production field has been,

A pen of gilts



of necessity, on a smaller scale than that seen in the marketing sphere. Marketing organizations may range from 25 to 100 members, while production groups tend to have between 3 and 10 members.

In the integration of production, producers have looked for economies in machine investment and operating costs, economies in labour, and in certain situations reduction in capital investment in buildings. The more closely integrated production groups may have group machinery covering all field operations from seed time to harvest with the product being conditioned and stored in group-owned central buildings.

In situations such as these, the need for technical advice is of paramount importance if the economic advantage of grouping is to be fully exploited, and it is indeed from this direction that the main demand for advice originates.

A pre-requisite to participation in group production activities is an examination of current farm resources and financial situation. These in turn must be weighed against the potential of the group venture. It is, perhaps, appropriate at this point to state that this preliminary appraisal has not been a feature of all group development.

Where projects involve the exploration of new markets, there is perhaps some justification for an 'act of faith' on the part of potential co-operators, but in the field of tried production techniques no such excuse exists.

New factors

Turning to the immediate situation, there is evidence of a number of features of co-operation which warrant comment and emphasis.

The advent of the *Central Council for Agricultural and Horticultural Co-operation* has added new impetus to the movement, and one is prompted to stress two features of this development. Firstly, the availability of grants should not be allowed to mask the overall economic soundness of a project, nor should they be permitted to obscure the paramount need for full member confidence and understanding in any group project. An attractive financial situation is no substitute for personal compatability. Secondly, the fullest possible use should be made of grants now available to examine the practicability or feasibility of new co-operative ventures.

Care is needed in the development of new organizations to avoid, wherever possible and where appropriate, the duplication of effort and the build-up of inter-group competition for markets. Producers, advisers and the Central Council all bear responsibilities in this direction.

Reference has already been made to the carrying out of preliminary appraisal of co-operative projects and to the need for member discipline. Skirting round these two features has been a weakness in some existing organizations and neither can be regarded as omissions which lend themselves readily to correction. More and more embryo groups are turning to N.A.A.S. advisers for guidance in this field and, as the group establishment may have a very considerable impact on the participants' business, the move is to be welcomed and encouraged. In demonstrating the economic consequences of grouping, an adviser simultaneously provides much of the practical reason for the acceptance of sound member discipline.

While many groups have grown to accept discipline as an essential feature of sound co-operation, some individuals regard this feature of grouping as 'cords that bind' and fail to recognize the safeguards it offers. A change of outlook in this direction is clearly desirable.

The future

Turning to the future, one can foresee a number of facets of group activity which will require constant and careful reappraisal if the maximum benefits of the enterprise or activity are to accrue to the participants. Allied to this are features which must rank in the forefront of any new developments.

The continued economic viability of a group will depend on the continuing examination of the cost-return pattern and it must be the first call on the directors and staff that this appraisal work be done. The dangers of top-heavy administration, excessive and under-used capital investment and lack of market exploitation can all lead to diminishing profits. Nevertheless, it is wrong to make an 'idol' of low overheads to the possible detriment of group expansion and restriction of member benefits. Clearly, group boards must be dynamic and it is the duty of members to see that they remain that way.

New fields

While groups now interest themselves in quite a wide range of commodities and activities, there is clearly considerable scope for *new fields* to be exploited. Where groups come forward with pioneering ventures, then the Central Council can do much to assist them, while advisers must be prepared to demonstrate, as far as their resources allow, the economic potential of such moves.

In the development of group activity in the production field, one can see very considerable scope for the emergence of a significant number of comparatively small organizations. Indeed, the size of production groups will very largely be governed by such things as geography, as it relates to road access, travel time and the like, plus such things as machine potential, soil type and labour utilization and availability. Given that all or most of these factors have been examined and exploited, then there is little danger in duplication.

The same cannot be said of marketing activities, and it is here that caution must be the watchword. A multiplicity of marketing organizations will weaken rather than strengthen group development with the employment of marketing management becoming an expensive luxury.

Liaison between groups must be encouraged and a lead taken to demonstrate to potential groups the advantages of using existing marketing facilities. Given that the marketing organization makes its requirements felt through the production chain, then the right article for the market should be forthcoming. In the situation where the commodity is reliable, then the amount which one individual can market efficiently may go up by leaps and bounds.

Economy in the production group and efficiency in the administration and marketing can, and should, lead to continued expansion of co-operation among farmers.

The author of this article is **John M. Ewing, N.D.A., N.D.D.H., C.D.A., C.D.D.,** who is Regional Co-operation Adviser for the N.A.A.S. in the Eastern Region.

Should a capital outlay of £70-90 per cow on modern umbrella type buildings be accompanied by a change in system also? This problem is discussed by A. W. Prowel of the National Agricultural Advisory Service

Wintering Cattle and Sheep

THE opportunities for successful livestock rearing, centre around good grassland utilization and a satisfactory conservation system which permits this.

Intensification on the livestock farm

Output over recent years has tended to be interpreted in terms of liveweight gain per acre. This is a measure of performance similar to yield per acre as applied to the dairy cow. To have a cash value, however, this live weight attained per acre must be realizable as a saleable commodity at a particular point in time.

Good quality, high output grassland is not difficult to produce today. The problem is one of converting this into real money value. Increased numbers of ewes and suckling cows carried may simply serve to aggravate the problem of small calves, poor stores and unfinished lambs on the market.

It is quite common to generalize on gross margins of £20 per acre from cattle and £18 per acre from sheep. There are farms not doing as well as this but there are also others doing considerably better. Case studies of comparable livestock farms quite often show differences in output of the order of £10 per acre. 'Finish' (or sale value) of the individual units of livestock marketed, plus good timing of sales, so often account for these differences in output and margin per acre between farms.

Cattle in winter

High output grassland is extremely sensitive and 'tender' to winter treading, and to prevent excessive damage and loss of grass production during the following spring it is becoming imperative to take cattle, particularly, off the grass for the winter. This means a greater need for accommodation. How much can these farms afford to spend on buildings? Can an injection of £70 to £90 capital per cow on a modern umbrella type building be justified? Should such a capital outlay be accompanied by a change in system also? Many farmers have thought so and have changed over to an all silage system.

To justify capital outlay, greater output and returns from grassland are necessary. It is difficult to increase fertilizer usage under a traditional haymaking system in which heavier crops are difficult to handle and harvest. Field haymaking does not offer sufficient flexibility in conservation that better grassland management and utilization requires. A silage system can be more easily harnessed to higher output per cow also. The cattle policy on a self-feeding silage system has been inclined more towards autumn calving.

Calves are born in the late autumn and overwinter indoors with their dams. The calves have their own runback and lying area where they can receive a little dry food. By the spring they are well grown, and from then onwards are able to make use of grass and also suck their dams, and are well grown by the autumn sales.

On many farms a proportion of the autumn calving cows are capable of suckling more than one calf. By turnout in the spring one calf is weaned and the cow takes a single calf out at grass. Although extra feed costs are involved with winter calving, saleable calves are produced by the following autumn; calves that have made good use of summer grass and which will not be overwintered a second time. The extra calf can improve gross margins per cow by some £12–£14.

Where cattle are 'finished' at 15–18 months, early spring calving could well be the aim. After a relatively cheap first winter they can go out to pasture under controlled grazing conditions to finish indoors the following winter. On balance, *ad lib.* silage feeding of cows favours autumn calving. With spring calving under *ad lib.* silage systems a surplus of milk for the young calf often raises problems of digestive scour.

Double suckling

A typical example of a partly autumn calving herd in which some 20 per cent of the cows are double suckling is shown below:

Total Output	£	*Variable Costs*	£
Sales:			
39 Young cattle average £43	1,677	Purchased feed—Concentrates	312
7 Yearling cattle average £53	371	Purchased hay and straw	189
9 Cull and other cows	484	Veterinary costs	90
Cow and calf subsidies	1,410	Grass and forage costs	340
Plus valuation change	343	Haulage	98
	4,285		
		Purchases	
		Calves (12)	231
		1 Cow and calf and 2 bulling heifers	239
		Total variable costs	1,499
Output per cow	95	Variable costs per cow	34
Output per cattle acre	43	Direct costs per cattle acre	15

Gross margin per cow—£61
Gross margin per cattle acre—£28

The yearly average of cattle livestock units in this case was 59 and the stocking rate 1·7 forage acres per livestock unit.

Double-suckling autumn calvers received on average between £6 and £7 worth per head of balanced concentrates over the winter period, while single-sucklers received a mainly cereal supplement to the value of £2 5*s.* per head. The concentrate per calf was in the form of rearing cake averaging about £2 15*s.* per head.

A crop of swedes to help fill the 'winter gap' and to restrict the flock to a small area of the farm during winter

The sheep flock

There is one general point of difference between the breeding cow and the breeding ewe. The latter, when dried off, is not heavily pregnant. Quite clearly she should not be permitted to contaminate the pasture for the growing lamb, nor again to compete with it for goor quality grazing. By tupping time, however, she should be in thriving condition. After-treatment at this time of the year will determine what lambing percentage may be realized in the following spring.

Although so much has been written on the importance of feeding the ewe on a rising plane of nutrition during the last 6–8 weeks of pregnancy, the message is not always put into practice; neither is it always interpreted in the right way. It is known that appetite and intake of dry matter falls off in the later stages of pregnancy and quite often flockmasters do not substitute an increasing amount of low-volume, high nutrient value feed in place of roughage sufficiently early before lambing. This results in digestive problems, pregnancy toxaemia and losses.

Feeding costs

Breed, type and size of ewe dictate the feeding regime during the winter. Extreme examples of these are the hardy hill ewe and the big lowland ewe. With hill ewes the main consideration in certain seasons may be whether to feed or not to feed, and again the type of feed most suitable and economic to use. Work at Pwllpeiran Experimental Husbandry Farm on optimum protein levels and use of 'self-help blocks' under hard hill conditions is worth noting in this connection. In many flocks the feeding costs are about equivalent to the value of the wool clip. This applies under upland and lowland sheep systems.

A few years ago the N.A.A.S. in Brecon looked at the feeding practice and costs in lowland flocks with ewes of roughly similar type and breed. There appeared to be a marked response to feeding up to 30*s.* and more per ewe. The range of results showed output figures of from £7 15*s.* at a feeding cost of 12*s.* per ewe, rising to an output of £11 15*s.* per ewe at an expenditure of 30*s.* per ewe on feed. With good feeding and management the response in performance was very marked.

Weather conditions

The effects of wind and rain and fluctuations in temperature are well known. Work at the Hannah Dairy Research Institute has indicated the extent to which animal performance can be adversely affected by bad weather. In bad weather the ability to forage is much more restricted as also is the amount of herbage available.

Forage crops

Forage crops grazed off in the field can provide a great deal of keep during the winter. In various parts of the country root growing is still widely practised. Precision drilling and pre-emergence spraying has tended to keep costs down. The crop provides a useful source of food during the late winter and early spring period. A good crop of swedes of about 26 tons per acre with a run back on to grass is capable of providing sufficient keep for 30–40 ewes per acre of swedes for some 70–80 days. This means that the flock for this period can be restricted to a relatively small grassland area of the farm. The flock is still exposed to the weather, however and, under prolonged wet conditions, the ground conditions can become quite bad. Chemical destruction of the sward and sowing the seed in narrow drills, rather than ploughing, may provide the answer to the muddy conditions. A small-scale survey into the possibilities was carried out in 1967. This has been extended to a number of sites in 1968, when it is hoped that some indication can be obtained of the possibilities offered by this method of growing the crop.

In-wintering

Inwintering of ewes has received a great deal of attention during the last few years. It undoubtedly offers several management advantages, such as providing closer shepherding, better working conditions and opportunities for saving more lambs. Out of door losses at birth and during the few days following birth are quite high under adverse weather conditions. Ewes inwintered depend entirely on feed being provided for them, and under these conditions adequate and satisfactory feeding levels can be maintained. There are a number of disadvantages and these are very largely connected with overcrowding and bad ventilation.

Work at Research Centres and Ministry's Experimental Husbandry Farms have not shown any marked economic advantages as a result of in-wintering. In most cases outwintered ewes and their lambs have been slightly heavier than their inwintered opposites. There has been little difference between total herbage yields as between the ungrazed and winter grazed areas, although earlier grazing has been available on the ungrazed winter areas. The main purpose of inwintering it would seem, is to provide shelter from the weather, a fair degree of comfort at a low cost for the sheep and shepherd, and close management control.

Type of building

Any existing building, provided that the cost is kept low, can be modified to meet the requirements of inwintering. An example of a cheaply erected building is the pole barn type of structure at the Rosemaund Experimental Husbandry Farm. This has walls constructed of straw bales and wire netting

support. Built up to a height of 7 ft it provides a good shelter from wind and rain and plenty of ventilation space. It has the overriding advantage of low cost and it works successfully.

Trends

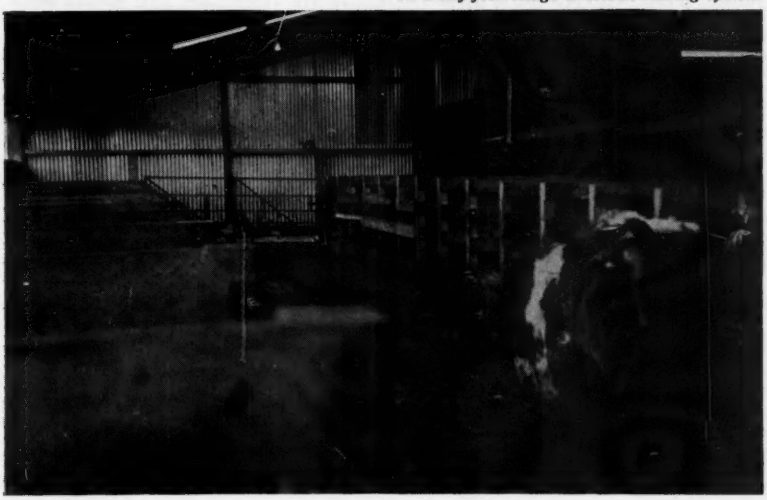
The economy of the livestock farm, particularly in the higher rainfall areas, depends on the use made of the grassland during the growing season. The greater the intensity of stocking the more critical becomes the need for taking the stock off the land during the winter time. This immediately raises the problem of more capital and the justification for sinking this in buildings. Quite often, without some completely new thinking with regard to the relationship of enterprises or system change, this has resulted in a disproportionate burden of fixed costs. Loose housing conditions (as opposed to cubicle systems) also bears the additional in-built high litter cost item.

Whilst it seems logical, therefore, that the economy of these farms can be improved through fuller and effective use of grassland during the grazing season, could not more use be made of some of the resources and by-products of the lowland arable farms during the winter time? This would involve bringing these to the stock or, indeed, taking the stock to them.

Bearing in mind the question of accommodation, the better alternative could be taking the stock to where the resources are available. Where these resources are on farms carrying no livestock, existing yards and buildings could be put to profitable use.

This whole subject of away-wintering has been given a great deal of serious consideration. The N.A.A.S. in Wales and the West Midlands, together with interested farmers, have met to discuss the practical implications. A certain number of cattle were away-wintered in 1966–67 and further developments had been planned for 1967–68 but had to be cancelled because of the foot-and-mouth epidemic.

A typical cubicle layout with calf creep in the background on a self-feed silage livestock rearing system



Real progress in away-wintering can only be made where there is a fair amount of goodwill and a degree of flexibility in arrangements made. There is no place for opportunism in such an undertaking. Farm planning on both sides is required, and a firmly based agreement on a properly costed basis is vital if there is any chance of away-wintering becoming a feature of the farming system.

The author of this article is **A. W. Prowel, U.D.A.**, who is County Agricultural Adviser, National Agricultural Advisory Service, for Brecon and Radnor.

The Cost of Weather

W. H. Hogg

THE eleventh in the series of Aberystwyth symposia in agricultural meteorology was held at the Welsh Plant Breeding Station on 13th March, 1968. The subject under discussion was: the economic measurement of weather hazards. This embraces a wide field of economic meteorology with many applications in agriculture, industry and the social life of the community. However, most of the contributions to the symposium dealt primarily with the agricultural aspects of the subject and in sum they reflected a wide interest in the economic advantages of using meteorological information in long-term planning for agriculture and in farm management.

Seasonal hazards

After the welcome on behalf of the Director of the Welsh Plant Breeding Station, the first sentence of the introduction by the convener of the symposium was: 'British weather costs money'—and this formed the theme of all contributions and discussions. Among the hazards mentioned by the convener were the overnight frosts in spring which, by cutting back early

potatoes, may cause losses of thousands of pounds to individual farmers. In contrast to these may be set the hazards which last for months on end, such as the snowy winter of 1947, which caused such loss to the national sheep flock. For Wales, the loss in the 1947 lamb crop has been estimated at nearly £4 million. More recently, there have been suggestions that wind could have been involved in the spread of foot-and-mouth disease during the early stages of the 1967 epidemic and, if this proves to be so, the cost attributable to weather factors may well be very significant. In a broader context, estimates were quoted of the present annual economic benefits to agriculture of meteorological advice and services; these were stated as £10 million which gives a benefit/cost ratio considerably better than 20:1, the overall figure estimated for the national meteorological services.

The role of management

In some rather specialized agricultural enterprises, such as intensive poultry, pig and beef units with controlled environment housing, there is little uncertainty and the role of management is thereby reduced. On the other hand other farm enterprises demand a high level of management, largely because they are weather sensitive. Weather sensitive decisions may be those of: (1) land use, (2) enterprise choice, (3) enterprise organization and intensity, and (4) day-to-day operational decisions. Management is largely concerned with categories 3 and 4. Often the successful farmer makes good subjective decisions concerning the weather when there are few alternatives and these are not too complicated, e.g., when to cut a hay crop, but as the problems become more fundamental, more sophisticated techniques may be needed, such as statistical simulation. For example, a cereal grower who is considering the purchase of combine harvesters, grain drying and storage facilities, has to make decisions on more than one weather variable, besides labour and other factors. To arrive at category (4) decisions a farmer must ask himself the following types of question: (*a*) are time and weather biologically suitable for drilling? (*b*) are time and weather physically suitable for ploughing? (*c*) if the answers to (*a*) and (*b*) are yes, what labour and machinery are available? With good weather data a farmer should need less capital in his business, or obtain a better return on the amount already invested. The use of local radio stations could perhaps help growers on the timeliness of their husbandry operations, as in the U.S.A.

Weather data for field operations

There were two contributions from the meteorological side and the first dealt with weather and machinery work-days. It was based on the assumption that the ability to carry out field operations necessary between seed-time and harvest is dependent largely upon recent and current rainfalls. It showed how standard weather data can be used to specify approximately the limits for each operation. These estimates can be made much more realistic where it is possible to record returns of work from farms on various broad soil types, as has already been done in the East Midlands. The results of assessing the number of work-days available clearly demonstrated the importance of soil type and thus added support to the validity of the methods used. A logical extension of this approach is to apply the criteria to recent and expected weather with the object of producing forecasts of the number of work-days, perhaps replacing the standard weather forecasts. Clearly, we

are not yet at this stage—at present the farmer must use the standard forecast as a basis for his own decisions over the next few days.

Weather data for agricultural or horticultural planning

The other meteorological contribution provided three examples of the ways in which weather data can be adapted for agricultural or horticultural planning. The first dealt with the susceptibility of particular sites to frost, mainly in relation to blackcurrant growing. It was pointed out that we can think in terms of a regional frost risk upon which may be superimposed an extra risk pertaining to a particular site, and that this extra risk can be expressed in economic terms. For example, it was estimated that the attempt to grow blackcurrants on a particular site in Somerset would, over a period of years, diminish the annual gross return by some £66 per acre, approximately the return from a half-ton crop. The second example dealt with irrigation need and showed how the adaptation of standard meteorological data and the calculation of water balance sheets by computer had led to the production of maps, from which may be read all the basic information necessary to judge the economic worth of particular irrigation schemes. The last example explained how temperature data can be adapted to determine the fuel costs appropriate to individual crops on a glasshouse enterprise.

Windblow hazards to forestry

In January, 1968, a gale caused severe damage in Glasgow and the neighbouring towns. It also blew some 30 million cubic feet of timber in West Central Scotland, which is about the volume normally cut in 18 months in the whole of Scotland. Windblow is clearly directly related to weather—if the wind is sufficiently strong the trees will blow. This poses many problems in forest management in attempts to minimize windthrow by increasing the stability of trees by drainage, in decisions on the likely benefits of thinning and, for some localities, in consideration of premature felling to avoid the likelihood of a blown crop. The other weather-related hazard in forestry is fire and this is most commonly started by people and then gets out of control. Since there are more people about in fine weather, fires are more likely then. In this country, fires are most likely to start between 12 noon and 6 p.m. and most losses occur in the spring. Once a fire has started, the danger of its spreading depends largely on the weather and this is assessed by the Forestry Commission, using observations and forecasts of rainfall, humidity, temperature and wind.

Labour

The effect of weather on the availability of labour can lead to variations in farm profits and an interesting theoretical exercise was described for the Edinburgh district. With an arable farm of 403 acres in mind, the rainfall records from three nearby places were used to define the number of hours suitable for outside work. By linear programming, these three sets of workable time were then used successively to arrive at three optimal plans for the farms, the only variable parameter being labour availability. The differences between labour availability were most marked in winter and spring, and least in summer and the harvest period. The main effect of weather on the optimal farm plans was to increase the percentage of roots with lower

rainfalls, with a corresponding reduction in the cereal acreage. Because of the effect of weather on labour availability, there was a difference in profit of over £3 per acre between the hypothetical farms.

Other factors

Clearly some crops are much more weather-sensitive than others and this was demonstrated in a short study on the areal patterns in the value of early potato production in South-West Wales in 1967. This emphasized that environmental differences on a mesoscale (i.e., over distances of only a few miles) can be just as important as those on a macroscale. An attempt was made to relate economic returns to physical factors. For example, the change of soil from sandy loam of the Old Red Sandstone to the heavier soil further north produced a delay of about two weeks, or a difference in price of around £14 per ton. The effect of temperature on earliness is also of great importance, leading to differences of £24 per ton along the south coast, but considerably more in the north. Frost is the major temperature hazard, and one of the main disadvantages of sites away from the coast is variability of yield because of frost—in successive years the yield of the same variety in the same field changed from 8½ to 4 tons. Other factors are rainfall, with the possibility of a need for irrigation, and such site factors as aspect and exposure; the latter may cause salt damage as well as direct physical damage to the growing crop.

The future

All the papers provoked a lively discussion and the participants in the symposium were left in no doubt of the importance of using weather data as fully as possible in the planning of farm enterprises. The contributions to the symposium are to be published and will form an interesting and useful set of reference papers.

The author of this article, **W. H. Hogg, M.Sc.,** is a Principal Scientific Officer of the Meteorological Office and is attached to the Ministry's Office at Bristol, covering the South Western and West Midland Regions and Wales.

Binder for 'Agriculture'

Readers will be interested to know that a binder to hold their copies of 'Agriculture' is available.

The binder comprises two stiff covers bound in dark green material and joined together by a spine covered in similar coloured leatherette on which the title 'Agriculture' is embossed in gold lettering. It holds twelve copies of the journal.

The price of the binder is 12s. 6d. (by post 13s. 8d.) and is obtainable from H.M.S.O., P.O. Box 569, London, S.E.1., Government Bookshops (addresses on page 556) or through any bookseller.

Applying paraquat by dribble bar

Weed Control in Forest Nurseries

J. R. Aldhous

FOREST nurseries in Britain raise stock each year to plant some 80,000 acres —either in ground to be newly planted with forest trees or for replanting in recently felled woodland. Roughly sixty per cent of these plants are grown in Forestry Commission nurseries devoted to their production, while most of the remainder are produced in privately owned nurseries growing not only trees for forest plantation but also ornamental trees and shrubs, hedging stock and trees for roadside planting.

The total area of land under young trees destined for the forest is a little less than 2,000 acres, a trivial area compared with most other agricultural and horticultural activities carried on without glass. Because of the small size of the forest nursery industry, few manufacturers are interested in developing products exclusively for forest nurseries. In practice, nurserymen use or adapt to their needs, horticultural and agricultural equipment and techniques. The only organization investigating forest nursery techniques, and testing new pesticides for their suitability for forest nursery stock is the Forestry Commission, through its research staff and outstations in various nurseries.*

Conifers dominate production; over 95 per cent of all plants raised are coniferous. More hardwoods are produced for use in private forestry schemes than for planting by the Forestry Commission, as the latter has usually to deal with the less fertile soils and the more adverse climatic conditions where hardwoods are unlikely to form economic forest crops. Those hardwoods that are raised are mainly for amenity and comprise oak, beech, birch, sycamore, poplar and a few alder.

*Forestry Commission Reports on Forestry Research are issued annually and give details of current research on weed control in forest nurseries besides information about other work on forest nurseries and forests.

Young trees spend between two and four years in the nursery before they are big enough to survive planting and subsequent weed competition in the forest. While growing in the nursery, young plants are particularly susceptible to weed competition, especially in the early part of the growing season when there is plenty of space between plants for weeds to develop. It is really surprising how slow young trees are in the early stages of growth, considering that on the sites of many forest nurseries most species can reach 100 feet in height and some could exceed 200 feet if allowed to mature.

The sale value of a crop of young trees averages £250 per acre but can reach £400 or more. The cost of any technique that offers a saving in manpower or materials, or any means of increasing the reliability of production can, therefore, usually be justified by a relatively small increase in production, always provided that the cost of the technique itself is reasonably low. The weed-killers in general use in forest nurseries mostly pay for themselves several times over.

Methods of machine application

In most forest nurseries, weed control and other machine operations are planned around light to medium-power agricultural tractors and toolbar attachments. Seed is sown broadcast or in drills in beds, while transplant lines are in arranged beds of from five to seven lines, 6—9 inches apart. Normally tractor wheels are set at 5 feet between centres and easily straddle both seedbeds and lines, weed-killers being applied by belly- or rear-mounted sprayers operating at 30 lb per square inch.

Inter-row cultivation is less widely practised now that simazine has come into general use in transplant lines.

Small sprayers—knapsacks, or mounted on wheelbarrow-like frames—are sometimes used for spot or strip control of weeds, for example, for controlling patches of weed on fallow or waste ground, or for weeds on paths between beds of seedlings or transplants.

Types of weeds

The soils on which most young forest trees grow best are acid; a pH of 5 is optimum for many species. Much forest nursery work is done in late winter and early spring. Hence light soils are preferred both for their ease of working in the winter and for their acidity. Fewer species of weeds are encountered on such soils than on near-neutral soils; the most prevalent weed species encountered in a survey of forest nurseries in 1960 were the annuals—annual meadow grass (by far the most important forest nursery weed at that time), groundsel, corn, spurrey, chickweed and shepherd's purse. Perennials such as sheep's sorrel and various creeping grasses were present in many nurseries but were not a major problem, nor were common agricultural weeds like fat hen or annual nettle though, again, present in many nurseries. In the past five years, sheep's sorrel has, if anything, become more important as a forest weed while pearlwort has also been increasing in certain nurseries.

Whatever the weeds present, the objects of weed control in forest nurseries are the same as in any crop, namely:

in the long term to prevent weeds and weed seeds accumulating in the soil and to eradicate established perennials,

in the short term to prevent weeds smothering seedlings and transplants —the most critical period being the two months immediately after germination of seedbeds.

Methods of control

The first long-term object, which is to prevent the accumulation of weed seeds, might seem a pious hope but a high proportion of new nurseries created on light acid ground previously covered with bracken or heather or woodland—the so-called 'heathland' or 'woodland' nurseries—have offered just this opportunity. There is seldom much weed seed in the ground on such sites and with good management, the crops can be kept virtually free of weed competition without recourse to weed-killers. The best record is at Kinver nursery near Wolverhampton which remains practically weed-free after twenty years of cropping. This has been brought about by rigid control of plant movements and by vigilance. Firstly, no plants that could possibly bring weed seed in are allowed to enter the nursery; secondly, all manures are weed-free—hopwaste is the only organic used; thirdly, girls are sent out to search out weeds and are not considered idle if they only bring in half a bucketful after two hours' work!!

Unfortunately, the majority of nursery managers have been unable to maintain weed-free conditions even when given a weed-free nursery initially. In nurseries with a large weed seed population in the ground, herbicides, hand-weeding and cultivation have to be combined as seems most likely in the local circumstances to minimize weeding costs and at the same time ensure that crop growth is not checked by weed competition. Annual meadow grass can set seed in four to six weeks from germination; if allowed to grow for more than six weeks, the number of weeds compounds. Where hand-weeding is the method of control, the total time and hence cost of weeding goes up dramatically. However, the costs of different means of weed control are such that only in the virtually weed-free nurseries can managers afford to rely on hand-weeding. Elsewhere, it pays handsomely to use herbicides.*

Initially, seedbeds can be cleared of weeds by an oil or paraquat spray just before crop emergence. Most conifer species are slower to germinate than many weeds and the first flush of weeds to emerge can usually be eliminated by timely spraying. However, for a period of six to eight weeks after emergence, crops are too susceptible for any currently available herbicides to be used with safety and during this time weeds have to be controlled by hand. By mid-June many species can tolerate light doses of white spirit but such sprays are only really effective on newly-emerged weeds; older weed-growth usually recovers and needs to be removed by hand. The cost of weed control in seedbeds is £15–£40 per acre. In the period before herbicides were available, hand-weed control in seedbeds cost £75–£150 per acre and this at the wage rates of the late 1940s and early 1950s.

In transplant lines, simazine effectively controls weeds for 2–4 months, by which time most plants are out of the most sensitive period. Inter-row cultivation or carefully placed sprays of mineral oils can keep weed-growth down for the rest of the season. The cost of such weed control in lines is £10–£20 per acre compared with £50–120 by hand.

*Full details of herbicides recommended for forest nurseries are given in the *Weed Control Handbook, 5th Edition, Vol. 2*, price 27*s.* 6*d.* obtainable from Blackwell Scientific Publications, Oxford.

The materials currently in use include:

Vaporizing oil—effective against all newly germinated weed seeds, it does no harm to crop seedlings as long as they have not emerged; indeed, certain pine seedlings can tolerate the spray just after they have emerged provided the cotyledons and primary needles are protected by the seed coat. (The testa and cotyledons of the commonly used conifers appear above the ground at germination.)

White spirit is used on a limited scale for control of weeds after the crop has emerged, but six to eight weeks are needed to elapse between first emergence and the first suitable opportunity to spray so as to allow crop seedlings to acquire sufficient resistance to the oil.

Paraquat may be used as a slightly cheaper alternative to vaporizing oil for pre-emergence sprays. It has been used on a limited scale for control of weeds on paths between seedbeds and in exceptionally widely spaced transplant stock but can only be so used when there is no risk of the paraquat coming into contact with foliage or stems of the young crop plants.

Simazine is used extensively in transplant lines, though a few species (larches, ash, poplars) are less resistant to this herbicide than other conifer and hardwood species. Residues of simazine are thought not to accumulate on the light, acid soils of forest nurseries. Some damage does occur, however, due to over-dosing, particularly where tractors travel at less than the required spraying speed when accelerating or slowing at the beginning or end of a spray run.

Future needs and prospects

The forest nursery industry in Britain is small and entirely non-viable as the sole outlet for any specially designed weed-killer in view of the millions of pounds that have to go into the research and development of a new material. Forest nurserymen have to continue to rely on herbicides currently produced for agriculture and horticulture. In contrast, adaptations of tools

Bourne Nursery, Farnham, Surrey, is typical of the 'heathland' nurseries formed on light soils

and equipment are likely to remain within the competence of many of the more machine-orientated nursery managers, and improvements here are likely to arise from within the trade.

The prime current need is for more cost-effective post-emergence control of seedbed weeds. Lesser needs are for alternatives to simazine with no less a spectrum of weeds controlled but with a bigger margin of safety for the crop, and for improved means of controlling sheep's sorrel and pearlwort in seedbeds.

Beyond these short-term needs, there is a long-term prospect of radical change in forest nursery techniques. It is possible that ten years hence, seedlings raised in tubes or, for example, in plastic foam may be a competitive means of production. Weed control as a means to an end must continually be reviewed in the context of the most economical techniques to produce the established young forest plantation. If these more intensive means of production are generally adopted, the methods of weed control are likely to differ markedly from those in current use.

This article has been contributed by **J. R. Aldhous, B.A.,** who is Silviculturist at the Forestry Commission's Research Station, Alice Holt Lodge, Wrecclesham, Farnham, Surrey.

The Ministry's Publications

Since the list published in October, 1968, issue of *Agriculture* (p. 496) the following publications have been issued.

MAJOR PUBLICATIONS

Technical Bulletin 17. Bacteriological Techniques for Dairy Purposes (New) 13*s.* 6*d.* (by post 14*s.* 3*d.*)

Animal Diseases: Surveys Report No. 5. Calf Wastage and Husbandry in Britain 1962/63 (New) 12*s.* 6*d.* (by post 13*s.* 2*d.*)

MECHANIZATION LEAFLETS

No. 21. Rotary Cultivation (New) 1*s.* (by post 1*s.* 3*d.*)

No. 23. Barn Hay Drying (New) 1*s.* 6*d.* (by post 1*s.* 9*d.*). (Replaces F.M.L. 21)

FREE ISSUES

ADVISORY LEAFLET

No. 545. Potato Gangrene (Revised)

SHORT TERM LEAFLET

No. 17. Cleaning and Sterilizing Farm Bulk Milk Storage Tanks (Revised)

The priced publications are obtainable from Government Bookshops (addresses on p. 556) or through any bookseller. Single copies of free items are obtainable only from the Ministry (Publications), Tolcarne Drive, Pinner, Middlesex.

Crops affected by poor drainage. The dark areas in the fields show where poor drainage is limiting crop growth

Aerial Photography in Agriculture

G. H. Brenchley

DURING the past ten years aerial photography has been used on a gradually increasing scale in the Eastern Region, N.A.A.S., for the study of several important crop diseases, and it has proved increasingly rewarding. At Cambridge it is now a regular investigational technique, taking its place alongside the more conventional surveys and trials carried out by plant pathologists at regional centres. In departments of agriculture other than plant pathology, however, aerial photography as an organized and regular activity hardly exists in this country. There has been some photographing of trial grounds and similar subjects, but this seems to have been done mainly for record purposes: aerial photography has not been an integral part of the investigations. A good many photographs have also been taken by or on behalf of farmers, but nearly all of these are 'obliques', which are seldom satisfactory for serious study.

In the course of the work at Cambridge a number of subjects other than crop diseases have been photographed, and enough evidence has been accumulated to make it clear that most of the uses discussed in this article—those connected with land drainage, for example—are practicable, although

for lack of opportunity they have not been developed. In addition, there are uses for the practicability of which there is at present little evidence, although they are theoretically possible. In this category comes, for instance, the estimation of crop yields from aerial photographs, supported by data on varieties, sowing dates etc.—a valuable use should it prove feasible.

Plant pathology

So far it is only in plant pathology that the technique has been used long and systematically enough to have yielded results—as opposed to giving indications that results might one day be obtained. The disease studied most closely is potato blight as it occurs in the south Cambridgeshire fens. The early stages of the blight epidemic in part of this area were photographed in several successive years, culminating in 1964 and 1965 in surveys covering about 80 square miles. These surveys, and the ground checks based on the photographs, pointed to the important part played by dumps of discarded potatoes as sources of early infection for nearby potato crops. The comparatively large area surveyed made it reasonably certain that the results obtained were the rule and not the exception, and so made it possible to base a modified advisory campaign on them sooner than would otherwise have been safe.

Take-all, one of the potential threats to intensive corn growing, has also been studied with the aid of aerial photographs. This work, which is still in progress, suggests that in the dry conditions of eastern England, take-all only causes serious losses when some other environmental factor, usually impeded drainage, is already checking the growth of the crop. Impeded drainage may be due to natural causes, but it is often associated with the panning and loss of soil structure that can result from working the land when it is unfit. These different types can easily be distinguished in aerial photographs, which may therefore indicate ways in which to avoid future trouble. With soil-borne diseases like take-all, the photographs record, not the amount of disease (as measured by the proportion of plant roots affected) but the outcome, as expressed in crop growth, of the complex and continuously changing balance between the crop, the parasitic take-all fungus and the environment. This summing-up, by the photographs, of the state of growth of the crop is, for practical purposes, more important than the measurement of the disease factor alone: pilot trials suggest that with more experience photographs could be used to assess yield losses, even though they might not enable the contributory factors to be individually evaluated.

Docking disorder of sugar beet and other crops is a soil-borne disease that illustrates some of the advantages of the technique. Although in many cases the immediate damage to the seedling beet, which results in the characteristic patchy stunting of the crop, is caused by free-living nematodes, the intensity of the attacks is largely determined by the nature of the soil and subsoil. Aerial photographs demonstrate that on the light sandy drift soils of East Anglia, where the trouble is common, the variations in growth are frequently associated with periglacial patterning* of the soil, usually unintelligible from the ground but clear in aerial photographs. These record the exact positions of affected areas; this means that the soil can be examined after the crop has been lifted, and that comparisons can be made with patches that occur in the next beet crop in the field or in other, intermediate, crops. By providing clues

*Patterning resulting from the freeze-thaw conditions associated with the presence of nearby glacial ice in Pleistocene times.

to the nature of the soil differences, the photographs give a direction and a precision to the ground investigations that would otherwise be lacking. Aerial photography has played a valuable part in the work on this disorder, not only in the investigation of its cause but in determining the extent of its occurrence. For this latter purpose, surveys of considerable tracts of country have been carried out; in one year, 1965, about 450 square miles in Norfolk and Suffolk were surveyed in this way for the Sugar Beet Research and Education Committee, while smaller areas, where the trouble most often recurs, are photographed annually.

Other diseases successfully recorded, but on which, for lack of opportunity, little or no further work has been done, include yellow rust of wheat, verticillium wilt of lucerne and of potatoes, halo blight and anthracnose of dwarf beans, celery leaf spot, arabis mosaic in strawberries and pea early browning. There is no doubt that a number of others could be recorded if the opportunity occurred.

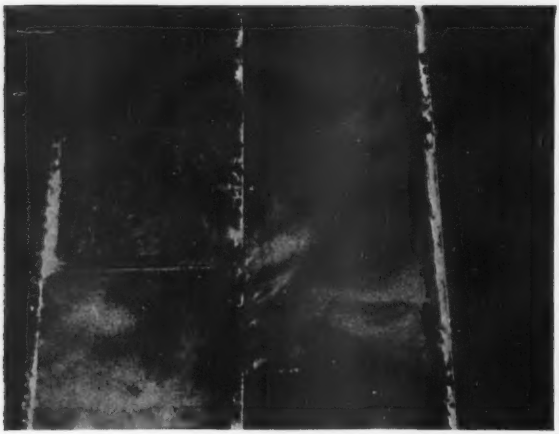
Some other uses

There are many other possible uses of aerial photography in agriculture: the three discussed below are taken as examples.

Recent years have seen a great increase in the corn acreage, and much of this has come, directly or indirectly, from the ploughing up of permanent pasture. Drainage that was adequate when the land was in grass often fails to cope, after a few years, with the needs of arable farming. Thousands of acres are in this condition, and very often the installation of an effective drainage system involves working on a scale much greater than that of the fields immediately affected. When this is so, the first step should be to obtain a bird's eye view of the whole local situation, and for this purpose aerial photographs are the ideal means, since weak areas in crops usually show up well and the photographs greatly simplify the necessary ground investigations. An example of the record that can be obtained of badly drained land is given in the photograph of part of the Bure marshes in Norfolk on page 527.

As the number of successive corn crops increases, so does the amount of nitrogen used, and this is probably one reason for the prevalence of lodging. Apart from the inevitable loss of yield, the increased number of volunteer seedlings from shed corn in lodged crops adds to the risk of transmitting diseases such as mildew and yellow rust to early autumn-drilled cereals. Some of this lodging is no doubt inevitable, but much could probably be prevented if the exact causes were understood. Lodging shows well in aerial photographs, and in most cases it exhibits characteristic patterns, usually unrecognizable from the ground. These patterns, when analysed, should enable the contributory causes to be identified. A topical use would be to record the effect of growth regulating substances on lodging over a wide range of conditions, provided that untreated areas were available for comparison.

Imperfect drainage and excessive lodging are chronic troubles which aerial photography might help to cure. It could also be of value in studying acute disasters, such as flooding or the 'blowing' of light soils recently experienced in East Anglia. The photograph on page 530 shows the result of the blowing of a very light sandy soil in Norfolk, photographed a few weeks afterwards: the relation of the spread to a long gap in the hedge is visible. Had an extensive survey of this area been possible, it could have provided material for investigating the effect of types and sizes of hedges, sizes of fields and other



Blown sand at Hockwold, Norfolk. The light toned areas are blown sand

factors on the extent of blowing. Any investigation would involve much field work, but photographs would make this much more effective. They would enable the investigators to make a preliminary classification of the types or degrees of blowing, so that the field work could be organized to the best advantage. The benefits of being able to plan an investigation in this way will be fully appreciated only by those who have experienced them.

The use of aerial photography for making livestock inventories is likely to be of more importance abroad than in this country, though even here there might be occasional scope for it. An experimental survey of a ten-mile stretch of rough grazing between the two main artificial drainage channels in the Fens, an area difficult of access on the ground, was found to compare satisfactorily with a ground survey, and was achieved more easily. Since nearly all the aerial photographic work on agricultural subjects has been done in the eastern counties there has been little opportunity to examine the possible uses of the method in areas predominantly devoted to grass and stock.

Future needs

The main requirements for the fully successful use of aerial photography in agriculture may be considered under the following heads:

Timing of the photography. For photographs of some subjects—e.g., bare soil, or a relatively static disease such as docking disorder, precise timing may not be necessary. Work of this kind could often be planned in advance and carried out by the established survey firms. But for photographing fast-developing epidemic diseases, or for studying lodging patterns and some drainage problems, the work might have to be done at a few days' notice. For such purposes it seems necessary that an aircraft should be directly under the control of those responsible for the investigation; the characteristic primarily needed is flexibility of organization.

Photographic quality. For much of the work, very high photographic quality, though always desirable, is not essential, though it is necessary in special cases—if, for instance, a microdensitometer is to be used to measure tone-differences.

Processing. The photographs should never be an end in themselves, and often much of their value is lost if they cannot be taken into the field before the situation there has changed appreciably. A priority system would be needed to ensure that prints from 'urgent' films were in the hands of field workers with the least possible delay.

Interpretation. This should be done by those who combine a knowledge of the farming side—soil types, diseases and pests, husbandry methods and the like—with experience of vertical aerial photographs. At present, interpreters with these qualifications are uncommon, and there is, unfortunately, little published information on the difficult subject of interpreting photographs of agricultural crops, in which the continuous growth changes are complicated by varietal differences and by different farming practices. Although much can be done by training and experience, the best interpreters are those with a natural flair for the work.

Associated field investigations. There is room for much variation here, but a basic method would be for individuals, or very small teams, trained in the use of photographs in the field, to work alongside those with local farming experience and, when necessary, with specialists in soil science, plant pathology etc.

There is a steadily increasing interest in aerial photography on the part of experimental farms, advisers faced with problems affecting groups of farms, and farmers themselves. This interest brings with it certain dangers. Photographs taken without regard to the requirements given in this article will often be disappointing and may bring the technique into disrepute. Meanwhile it is clear that the provision, in full, of these basic necessities would raise many problems of staff, training, organization and finance. But the problems are not insoluble, and their solution, at least to some degree, is necessary if aerial photography is to make the contribution to British agriculture of which it has already shown itself capable.

The article has been contributed by **G. H. Brenchley, M.A.,** who is a Plant Pathologist with the National Agricultural Advisory Service at Regional Headquarters, Cambridge.

The 1968 Royal Smithfield Show and Agricultural Machinery Exhibition will be held at Earles Court, London, from 2nd to 6th December (inclusive).

Horticulture in Guernsey

D. J. Harrison

TEN years ago the impetus towards modernization which has, of late, had such a marked effect upon the glasshouse industry in England, had made little real impression upon Guernsey. The traditional 30-ft span heavily rafted timber houses remained virtually the only type considered when rebuilding or expansion was under review. Similarly, most heating systems consisted of hand-fired solid fuel boilers set in pits and serving 4 in. cast iron heating pipes.

However, Island growers, well served by a number of well-informed bodies, including their own Guernsey Growers Association and an emergent advisory service, were aware of the economic arguments for modernization and some progress has recently been made.

Any assessment of Guernsey horticulture must be considered in the light of the development of the glasshouse industry, as the past has a significant bearing on the position as it is today.

The earliest commercial glasshouses were built during the latter half of the nineteenth century by shipwrights as the demand for wooden ships declined. Islanders found that a better livelihood could be obtained from exporting glasshouse crops than from farming, stone quarrying and fishing. Land has always been in short supply and, with money limited, the Islanders were able to purchase only small parcels of land—hence the tendency to build a dwelling with such glasshouses as space and capital allowed. This rapid early development was especially a feature of the northern parishes and today it is an interesting experience to drive through these areas, honeycombed as they are with seemingly endless narrow lanes winding between stone walls, which are bordered on every side with a great variety of dwellings each with its own greenhouses. Where land and capital were more readily available, development occurred on a larger scale and gradually the industry spread southwards into the high parishes. The position today is that approximately 50 per cent of the 2,800 growers occupy nurseries with less

than ¼ acre of glass while a further 40 per cent have between ¼ and ¾ acre nurseries. Within these scales of operation capital is not always readily available for rebuilding, while land for expansion is at a premium. The tendency is, therefore, for the larger and more heavily capitalized business to modernize and expand while the smaller growers tend to lag behind. There are, of course, exceptions to this general trend, especially amongst the younger and more progressive elements.

Rebuilding for the future

At the time of writing, a considerable proportion of the 1,150 acres of glasshouses occupying one-fifteenth of the surface area of the island are in the process of becoming outdated. Traditionally Guernseymen have built individual timber houses. The floor area has been kept free of obstruction by building methods using stout rafters (7 in. × 3 in. timber) and joists. Glass size has until recently been 20 in. × 18 in. or less. Frequently orientated north and south and set side by side, the amount of shadow cast by rafters, joists, purlins and glazing bars has been considerable and much of the advantage of natural light enjoyed by the island's location is lost. Recently designed 30–40 ft span houses in timber have been improved by the use of smaller rafters, metal joists, 24 in. sq. glass and additional height to the eaves; the extent of the roof ventilation supplied has also been increased.

However, the facts are that rebuilding is proceeding at not more than 20 acres a year and of these 75 per cent are timber houses. The arguments for these are based largely on cost as the price of wooden houses is approximately one-third less per unit area than metal houses covering a similar area. The arguments once vehemently put forward for reduced heat losses from timber houses are now rarely valid.

Controversy over glasshouse design

The same controversy over glasshouse design rages in Guernsey as elsewhere. There is a cautious interest shown in medium and wide-span houses and a similar curiosity regarding narrow span houses based on the Dutch 'Venlo' conception. Likely return on capital invested is, naturally enough, at the centre of the argument, but other considerations include ease of maintenance, glazing techniques and after sales service. In given situations, reasoned arguments can be and are made for all types but if, at the present time, any one type of metal house appears to have more advocates than others it is the medium span house erected as a two or three bay unit orientated east and west and providing an unimpeded working width of upwards of 80 or 120 feet. The Guernsey Horticultural Advisory Service at their St. Martin's Experimental Station is already examining the case with comparable areas of medium span and 'Venlo' type glasshouses.

Movement towards better heating

The desirability of glasshouse heating improvements has probably been received with more general interest than the need for rebuilding and this is especially true of boiler and firing improvements. Boiler efficiency and automatic firing has appeal for both the large and smaller grower in terms of fuel saving; economy of labour for the former and economy of personal

effort for the latter. When new nurseries are being built or older ones reconstructed, there is a definite movement towards steam or steam/hot water dual purpose boilers. Firing of these new installations is generally by oil of which only the 200 second grade is available to island growers at the present time. The wider advent of static packaged boilers inevitably heralds the demise of the horizontal locomotive steam boilers which have been such a feature of island life in recent years. They will probably become immobilized to an increasing extent and used to augment nursery heating systems as auxiliary boilers rather than for purposes of soil sterilization for which they have been supplied by contracting services for so many years. It is of interest to note that 85 per cent of the glass is heated.

While heat distribution on most nurseries is still by 4-in. cast iron pipes, newer installations favour accelerated hot water using loops of mainly $1\frac{1}{2}$ in. steel pipe. Double loops are almost invariably fitted at low level so that two rows of tomato plants are served. The desire for a heat supply close to the plants and near to soil level is unshaken and probably unshakable.

Up-to-date nurseries are also fitted with automatic ventilation, automatic irrigation systems and carbon dioxide distributing equipment. CO_2, either in liquid form or through propane burning, has many advocates amongst both tomato and cut-flower growers.

Tomato growing

With tomatoes still by far the most important crop, much attention continues to be centred upon growing methods and varieties, and it is apparent that considerable changes have taken place in the last five or six years. The main changes in growing techniques include a general tendency towards earlier sowing; many growers now sow in early or mid-November, some three weeks earlier than was the general rule. The $4\frac{1}{4}$-in. propagating pot has become more widely accepted and the use of loamless composts in plant propagation is increasing rapidly.

In addition to earlier sowing, many growers are using generally higher temperatures at night both during propagation and after planting out. It has also been generally accepted that temperatures during the day should be limited to 75°F. As a rule, growers are now supplying their plants with rather more water throughout the life of the crop and this is frequently based on advice given by the experimental station.

The picture with regard to varieties has changed quite dramatically. A few years ago more than half a dozen varieties were widely grown and included such well known names as Potentate, Moneymaker and Potential. At the time of writing, it is said that 99 per cent of all the island's glasshouses are planted with the variety Eurocross B.B. Ease and freedom of setting, earliness, freedom from greenback and to a considerable degree boxiness, plus a high percentage of the fruit qualifying for the best grades, account for the widespread popularity of this variety. Regarding culture, fruit quality and yield in general, it is interesting to observe that, whereas the tomato was at one time beset with serious disease problems, many good growers now claim that if a greater degree of tolerance to or immunity from tomato mosaic virus can be obtained, the greatest of the current disease problems will have been overcome. In respect of this, island growers are following with keen interest work currently being done at the Glasshouse Crops Research Institute.

While in recent years the total area of glass has not increased noticeably, tomato exports have increased from 7,000,000 12-lb trays in 1963 to 9,500,000 12-lb trays in 1967. This is due to some extent to a switch from flower crops but even more to a general improvement in what were already exacting standards of production. The use of steam for soil sterilization has increased and the techniques of steaming have been improved. The efficiency and adequacy of heating systems has risen. Growers have become increasingly outward looking and meetings and demonstrations are well attended. Guernsey growers have always been well served and serviced by ancillary trades and industries and these services have continued to provide excellent support.

Guernsey advisory services

In 1955 the Guernsey Growers Association asked that an advisory service for growers be provided and in 1956, three technical officers were recruited to form the basis of this. In 1962 an experimental station became operative and the total complement of the service now exceeds forty and includes fourteen technical officers. The value of this service is now widely accepted by growers.

Apart from technical and management advice, soil analysis and diagnostic work on crop pest and disease problems, the service has a range of experimental and demonstration glasshouses at St. Martin's, where work of relevance to the local industry is undertaken. The advisory service has also been instrumental in developing a comprehensive scheme for incentive payments to workers employed in tomato growing. This has been well received by the industry and widely adopted on the larger vineries.

It has been estimated that 50 per cent of the adult population of the island is now engaged in one aspect or another of the horticultural industry and the numbers would seem to be increasing. But in spite of modernization in a number of directions, certain tasks, especially in tomato growing, still defy mechanization and the average number of people engaged per acre of glass has fallen only fractionally in ten years. The scheme of incentive payments may, however, enable the larger nurseries to economize on or re-deploy labour.

Glasshouse flowers

While tomatoes remain the mainstay of the industry and account for a large proportion of the £12½ million of horticultural exports, a very lively interest remains in the production of glasshouse flowers. About 200 acres of glass provides a winter crop of Wedgewood iris from bulbs, or freesias from seed sown in the late spring or imported corms. Approximately 100 acres of glass produces 'flowers' and a breakdown of this would show that asparagus fern (30 acres), roses (30 acres) and carnations (15 acres) are the most widely grown subjects. The once huge grape industry has declined to something less than twelve acres in extent. A number of flower growers are working together towards co-operative marketing and there is at least one group which has implemented a scheme for central grading, packaging and marketing under a distinctive brand name.

Looking towards the future

It is no easy matter to attempt to summarize the Guernsey horticultural industry and its future in a few words but it is probably fair to say that

the industry has reached a watershed in its development. Between the two world wars the acreage of glass almost doubled to 1,000 acres. Since 1946 about 250 acres have been built and 100 of these have been to replace an equivalent area lost during the war. Much of the glass is, therefore, becoming dated and more than two-thirds of the total area is occupied by small growers working on modest profit margins and in a climate of ever rising costs and land values. Perhaps the most urgent requirement of the industry is glass replacement, with houses specially designed to make the uttermost use of the ground area covered and give improved light transmission and automation which will, by means of greater cropping potential, enable Guernsey growers to achieve the greatest possible advantage from their inherent skills. It is likely that in the future there will be an increase in the holdings of the larger organizations but it is also likely, because of the spirit of independence which is so strong in Guernseymen, that the means will be found for the smaller nurserymen to modernize and progress. It would be wrong not to mention the progress which is being made in horticultural education and training. This work, which is organized by the Education Council, working closely with other organizations, should ensure that the industry does not lack skilled management and technicians in the future.

This article has been contributed by **D. J. Harrison, B.Sc. (Hort.) (Reading), Dip. Hort. (Reading), M.I. Biol.**, who is a N.A.A.S. Horticultural Adviser. Before joining the N.A.A.S. in 1961 he spent six years in the States of Guernsey Advisory Service. The article was written after the author's visit to Guernsey in March, 1968.

Prospects for Brassicas

Kale

Rape

Swedes and Turnips

T. D. Johnston

THE agricultural brassicas—kale, rape, swede and turnip—may not appear to be very important in British agriculture when judged by the Ministry's acreage returns, but to farmers who grow them they play a very important part in the overall plan for providing feed for livestock through the year.

These crops are well suited to the British climate, especially to that in the wetter and milder western areas. Their value lies in their ability to produce, relatively cheaply, large quantities of fresh feed for use during the lean winter months. However, they present problems and have disadvantages, some of which are inherent in that they are arable crops intended for winter use and others are attributes of the stocks currently available. It should be possible to eliminate or reduce the latter by breeding new varieties.

The main problem with kale lies in the fact that, for cheapest production and utilization, *in situ* grazing is practised which leads to very muddy conditions and causes considerable inconvenience, especially when milking cows are being used to eat the crop. Recent developments on direct seeding may alleviate this difficulty since, if the seed is sown into a chemically killed grass sward, the persistent mat of dead sward helps to retain cohesion of the soil.

With respect to varieties themselves, the situation is much less advanced than with many other crops. With the exception of swedes, little breeding research has been carried out until recently, and within the main types of forage brassicas there are hardly any distinct varieties available. This situation may be attributed mainly to the relatively small acreages under these crops, the very small turnover of seed in the trade, and the fact that as they are not cash crops their potentialities and drawbacks are not as readily appreciated as those of other arable crops. Modern breeding and research techniques are, however, pointing the way to improvements in these crops.

Kale

The two main types of kale, marrow-stem and thousandheaded, are capable of giving large bulks of fodder throughout the winter months when a succession of types for early and late use is sown. Marrow-stem is more suitable for the earlier half of the winter because of its high yield but only moderate winter hardiness, followed by the more hardy but somewhat lower yielding thousandheaded kale for mid- and late-winter.

The present types are variable within the crop but very few distinctive varieties are available. Some variation in appearance from plant to plant is probably not important in a crop destined for animal feed, but there is also variation in other important characteristics which reduces the value of the crop. In marrow-stem kale the main problems are the improvement of its winter hardiness, total yield and, especially, the edibility and digestibility of the crop. The problem of wastage by the grazing animal and low level of digestibility of some parts of the plant is especially evident in this crop. In a typical field of marrow-stem kale the leaves contribute about 30 per cent of the yield and the stem the remaining 70 per cent. Whereas the leaf is palatable and digestible, the stem gets progressively less so from the growing point down towards the ground; in practice, up to half of the stem may be rejected by the animal and remain after grazing—in other words about one-third of the total original crop may be lost. Thus, improvement in feeding quality of the stem could lead to better utilization and, therefore, higher effective yield. Research has shown that wide variations exist among plants in the degree of woodiness of stems and recently a new variety, Maris Kestrel, has been released which has a much improved stem quality, together with greater winter hardiness and leafiness, than existing stocks of marrow-stem kale. This represents a very useful step forward, but the variety is a double-cross hybrid involving special techniques in seed production (Thompson, K. F.,

Agriculture, Vol. 65: 487–491) and in consequence the seed is more expensive than that normally sown.

Future progress in breeding varieties of marrow-stem kale is likely to be along the lines of improvement shown to be possible by the production of Maris Kestrel, with the eventual development of leafy types with stems of high-feeding quality and suited to specific needs, such as short plants for electric fence grazing, or tall and very high-yielding ones for cutting and carting. If these improvements can be brought about without using the hybrid breeding technique the seed need not be appreciably costlier than traditional varieties.

In thousandheaded kale the emphasis is almost entirely on maximum yield of leaf and the ability to hold the leaf through the winter. This is likely to lead to less obvious improvements than in marrow-stem kale. Nevertheless, progress is being made and in addition one aspect common to both types of kale is receiving attention, namely, the presence in the plant of small quantities of undesirable compounds. These substances cause tainting in milk, or interfere with iodine metabolism in the animal which may reduce fertility or thriftiness. The content of these compounds varies from plant to plant and it should be possible for the plant breeder to reduce or even eliminate these substances. By the use of such varieties the problems associated with feeding large quantities of kale in the diet would be alleviated.

Rape

The special value of this crop lies in its ability to produce in a short growing period, even under semi-upland conditions, large bulks of leafy feed particularly good for fattening lambs. It is also attractive because of the cheapness of seed and ability to compete with weeds in a broadcast stand.

Because of these virtues it has tended to be regarded as a crop which can be given the minimum of cultivation and fertilizers whereas, to get the best from it, an adequate supply of nutrients is essential, and in many instances the fertilizer bag can do more to raise yields than the plant breeder can ever expect to achieve.

Present-day varieties are broadly classified into giant and dwarf types, but there is no clear distinction, and in respect of leaf yield there is virtually no difference. The taller growth habit of giant rape may, however, give it some advantage in competition with weeds. Two lines of investigation are receiving the particular attention of the plant breeder at present, namely, raising the level of winter hardiness and producing high-yielding types with resistance to clubroot disease.

Clubroot disease, or 'finger and toe', is a widespread soil-borne fungus disease capable of attacking most brassicas, but is particularly severe on rape and swedes. It is very persistent in the soil, not easily controlled by chemical or cultural means, and susceptible crops grown too frequently in the rotation quickly lead to severe increase in disease level. However, 'Nevin' rape developed at the Welsh Plant Breeding Station is resistant to some of the races of this disease and can give a full crop under conditions when other varieties are severely checked. Also, National Institute of Agricultural Botany trials have shown that the yield of Nevin compares well with the best existing types even when the disease is not present, and it has given consistent indications of better palatability. It is expected that future varieties will carry

resistance to even more races of the disease, combined with greater vigour, hardiness and palatability.

A discussion on rape would not be complete without mention of the fodder radish, a relatively new crop in this country but one which, under certain conditions, has advantages over rape. The prime virtue of the radish is its remarkably rapid growth which enables it to be sown later than rape or, if sown at the same time, to be used earlier. It is also capable of giving very high yields but, unfortunately, it is an annual crop and tends to come into flower about 2–3 months after sowing and then deteriorates rapidly in palatability and feeding quality. This rapid deterioration has led to many disappointments for growers of the crop, and those who contemplate its use should not sow it too early nor in too large an area that cannot be grazed off quickly.

Improved varieties of radish are now being developed which retain the rapidity of early growth but do not come into flower so quickly, thus giving greater flexibility in time of utilization. Tetraploid forms which have recently been produced are especially interesting in this respect as they are very bulky and late flowering. Also, interesting attempts are being made at various research stations to cross the radish with kale thereby producing a new species which, it is hoped, might combine the vigour and disease resistance of the radish with the biennial habit and winter hardiness of kale. Even if eventually successful, however, it will be a few years before such hybrids come on to the market.

Roots

In recent years the swede has shown a return to popularity in some parts of Britain. The increase in acreage of this very useful source of feed for wintering sheep, especially on upland farms, is mainly attributable to developments in techniques of growing, namely, precision drilling and pre-emergence weed control. These have led to drastic reduction in the labour requirements for cleaning and singling, and when grazed *in situ* the crop becomes a very cheap source of feed. Lifting and storage inevitably increase costs but mechanization of this operation is now feasible, although it is most effective on a uniform stand of plants. Thus, breeding for greater plant to plant uniformity is at present engaging the attention of breeders. The recently released variety Pentland Harvester demonstrated that such improvement specifically to suit the needs of harvesting machinery is feasible, and all future varieties should share this characteristic.

Other improvements sought in this crop are increased yield, winter hardiness and keeping quality, but without the hardness of root associated with high, dry matter content and good keeping quality, since excessive hardness may lead to earlier loss of teeth in sheep eating the roots. Disease resistance is also an important aspect of present research. Most varieties of swede are very susceptible to clubroot disease, which under conditions of heavy infestation can cause severe losses in the field and can lead to more rapid deterioration in store. The disease also adversely affects the saleability of the crop for human consumption. As in rape, the disease exists in a number of races, and breeders are at present trying to develop swede varieties of types popular in this country but carrying resistance to as many as possible races of the disease.

In hotter, drier than average summers, swedes may also become heavily infected with mildew on the leaves. The disease is especially evident on early-sown crops and this, combined with the greater likelihood of attack by swede midge on early-sown crops, causes farmers to sow swedes at around the middle of June. Earlier sowing can, undoubtedly, lead to higher yields if the health of the plants can be assured. Hence breeders are searching for resistance to the disease and to the midge, which may prove to be an even more difficult problem as no really effective sources of resistance have been found.

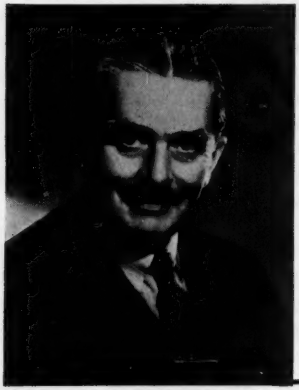
Turnips are generally of less importance than swedes as a root crop, except in the more northerly parts of Britain. Although somewhat quicker growing, they suffer the disadvantage of being less hardy and of poorer keeping quality. However, because of their speedy growth they have some special uses, such as in mixture with rape where the early bulbing forms help to balance the feed value of this rather high protein crop. In a new technique giving promising results a triple grazing can be achieved by mixing turnips with Italian ryegrass; at the first grazing the sheep eat off the ryegrass, at the next grazing the turnip, then in spring a regrowth crop of the grass.

Some varieties introduced from the Continent are able to produce quickly a large bulk of leaf and can be used in the same way as rape with the advantage of quicker development of a worthwhile crop. We may expect to hear more of these if the early promise is confirmed after more extensive testing, but otherwise no great advances in turnip breeding in Britain can be expected.

In conclusion, therefore, it is evident that the brassica crops are now receiving scientific attention, on a smaller scale but similar to that being received by other important crops, with valuable results for the farmer. In recent years, advances in techniques of growing swedes have led to a revival of interest in this most useful source of winter feed for sheep through reduction in cost and labour requirement. In addition, the possibility of sod-seeding techniques in growing kale will alleviate the problems of grazing in the wet winter months. Also, research has continually emphasized the necessity for ensuring adequate nitrogen and phosphate fertilizer levels if worthwhile crops of any of the brassicas are to be grown.

Although progress in the breeding of new brassica varieties has been slow, the objectives of the research have now been defined. These are, in the kales—better palatability and digestibility, and the absence of deleterious constituents, with greater hardiness in the higher yielding marrow-stem kales; in swedes—disease resistance and suitability for mechanical harvesting; and in rape—disease resistance and the possible use of alternative crops, namely radish or eventually radish × kale hybrids.

This article has been contributed by **T. D. Johnston, B.Sc.,** who is in charge of breeding and genetical studies on forage crops at the Welsh Plant Breeding Station (University College of Wales), Plas Gogerddan, Aberystwyth.



Sir Donald Vandepeer

(1890-1968)

SIR DONALD VANDEPEER, who died on 6th October, will be remembered by many readers of this journal as Permanent Secretary to the Ministry from the end of the last war until his retirement in 1952. He had spent virtually the whole of his long career in this Department, which he entered in 1909 when it was still the Board of Agriculture and Fisheries.

He started as a humble clerk, and his rise from the bottom of the ladder to the very top was a truly wonderful achievement. Needless to say it was also thoroughly well merited, for he was a man of considerable ability and of exceptionally sound judgment.

Success made not the slightest difference to his modest and friendly bearing. He was very approachable, and with staff he was always most considerate. Many who served under him have good reason to be grateful for his help and encouragement in their careers. He also took a keen interest in the social and sporting activities of the staff.

It was due largely to his influence that the Ministry established and maintained such excellent relations with the agricultural industry and the organizations representing all sides of it. During the war and post-war years he did much to ensure the smooth working of the machinery by which the industry was associated in local agricultural administration.

Earlier on, between the two wars, he gained much inspiration from the dynamic Arthur Street, with whom he worked closely for a time in the development and operation of agricultural marketing policy. He also was responsible for the preparatory work for setting up the State Veterinary Service.

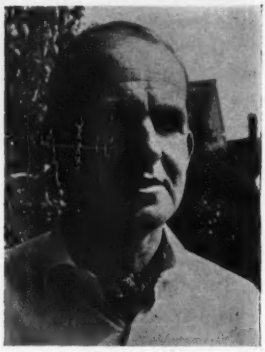
As Permanent Secretary after the last war he was faced with the many aspects of adjustment to long-term peace time policies. He perhaps escaped some difficult problems because food production for some years continued to enjoy much the same high priority as during the war. All the same, a great deal of the heavy spade work had been done when he retired.

'Van' was proud of his Department, and that compliment was warmly reciprocated.

RICHARD MANKTELOW

Agricultural Counsellor to the U.K. Delegation to the European Communities in Brussels, Mr. G. W. Ford, reviews the book *Food, Farming and the Common Market* by M. Butterwick and E. N. Rolfe. It has just been published by Oxford University Press, price 55s.

M. Butterwick



E. N. Rolfe

Food, Farming and the Common Market

THIS book deals with more than the title suggests. Part I describes the European Economic Community's common agricultural policy as it has developed in ten years of its existence between 1958 and 1968. There is a short outline of post-war agricultural policy in the United Kingdom, which is followed by an examination in some detail of the impact of the adoption of the common agricultural policy by Britain on food prices and on the balance of payments. There is also a chapter dealing with the British negotiations with the European Economic Community as regards the food and agricultural sector in 1961–63 and, more recently, with the British application to join the Common Market in 1967.

Part II takes one by one the major agricultural commodities that have been, or are planned to be, the subject of common managed marketing schemes in the Community. The arrangements and the production in the E.E.C. and Britain are compared and some estimate is made for each commodity of the way it may be affected if Britain were to join the Common Market. Part III contains a number of useful appendices which include statistics, a glossary of a number of technical terms,which today are part of the Community administrators' jargon and a few conversion factors which are very necessary to any British student of the Common Market until Britain goes 'fully metric'.

There are summary chapters on the common agricultural policy in various books on the European Economic Community. There have been several British official reports published by H.M.S.O. and there are numerous pamphlets, as well as frequent short articles in *Agriculture*, on the way that particular commodities are dealt with in the E.E.C., but there have been hardly any full length books, especially in English.* Accordingly, this book should help all those farmers, administrators and students who want to acquire a fuller knowledge of the working of the common agricultural policy.

I am sure that the authors would be the first to admit the need for caution in accepting, without considerable qualification, the likely impact of the C.A.P. on British agriculture. This is not to criticise the attempt but if Britain joins the Common Market there are many variables in the equation that cannot be known at this point of time. For example, it is likely that the agricultural policies of both Britain and the E.E.C. will have further evolved and the negotiations, themselves, may alter aspects of the C.A.P. Even more important are the supply/demand and the import/export situations of the present Community of some 180 million persons which would be quite different for a Community of ten member states with a population of between 240 and 250 millions. Finally, in this context, the devaluation of sterling has already changed the earlier calculations and any change in the future in the valuation of the currencies of the Common Market would have important repercussions.

The authors completed their book just before the fully comprehensive marketing schemes with common prices were fully worked out for beef and milk products. It will be useful to bring these matters up to date in any revised edition.

The Common Market has completed its first stage, namely that of devising basic marketing schemes for most of the major agricultural commodities. In the months ahead, the Community is due to devise and bring into force marketing schemes for liquid milk, fisheries, potatoes, mutton and lamb and tobacco as well as a number of relatively minor products such as flax, hemp and cork. However, of great importance is the work that is likely to be tackled this winter when the Community will be conducting its first full agricultural price review (the arrangements for which differ in a number of ways from those in Britain), together with an appreciation of the financial implications of the C.A.P. including the effects of the present largely open-ended system of agricultural support. Perhaps most important of all in the long-run, will be the plans for the development of the Community's agricultural structure policy. This book will provide a useful background to the understanding of the debates and decisions that are likely to take place in the autumn and beyond on these matters.

A mistake or two in a work of this size is inevitable, for example, the authors are not correct in stating that Belgium produces neither wine nor tobacco (page 217). Some wine, including a champagne type, is produced which might almost be called a by-product of Belgium's famous hothouse grape industry and there is an area in southern Belgium which grows tobacco.

*For readers of French, there are several books published by the *Editions Cujas*. For readers of Dutch, there is a most useful book: *Europese Landbouproblemen en Europese Landbouwpolitiek* by Dr. J. Van lierde, published by Standaard Wetenschappelijke Uitgeverig.

Liquid Fertilizers

Solid fertilizers have been traditional in Britain for many years. Will they continue to be so?

The author discusses the increasing use and place that liquid fertilizers have in present-day British agriculture.

J. Webber

TRADITIONALLY, fertilizers in Britain have been applied in solid form and it is only in recent years, first in the glasshouse industry and later also for field crops, that other forms have been used. Liquid fertilizers can take two forms; they may be gases kept as liquids by being stored under pressure in closed containers or they may be solutions of plant nutrients in water. The only example of the former is liquefied (anhydrous) ammonia which was the subject of an article by R. S. L. Jeater in *Agriculture*, November, 1966. A brief summary of information that has become available since then is contained in this article.

Fertilizers in solution, which include aqueous ammonia, other nitrogen solutions and liquid compound fertilizers have become widely available in recent years but still only comprise a small proportion of total fertilizer sales. Since their use is increasing it is appropriate, at this time, to discuss their place in British agriculture.

Liquefied ammonia

This is the most concentrated (82 per cent N) and per unit the cheapest nitrogen fertilizer available. It has, however, as a gas, to be stored in tanks under pressure and requires special precautions and equipment for handling. It must also be injected into the soil using machinery designed for the purpose, which adds appreciably to the overall cost and reduces considerably the advantage of its low unit price. In fact, at low rates of application, under about 80 units nitrogen per acre for arable crops, about 120 units per acre for grassland, the total cost of applied ammonia may be greater than that of a concentrated solid nitrogenous fertilizer.

Recent experiments confirm that liquefied ammonia is as good as solid nitrogenous fertilizers when applied in spring for arable crops. For grassland, most experiments suggest that ammonia is rather less efficient than

split dressings of equivalent amounts of solid fertilizer, while, because of the need to apply large amounts at a single application, it is much less flexible in producing grass when it is needed throughout the season. There is also a tendency for production to fall off in late summer when only a single application is given in spring. This cannot easily be remedied by a further dressing in summer as the ground is often too hard at that time for the injector to work satisfactorily.

Aqueous ammonia

This is a solution of ammonia in water and usually contains about 28 per cent nitrogen. Since it is in effect a saturated solution and readily loses ammonia to the atmosphere, it is stored under low pressure in closed containers and must be injected into the soil. A limited amount of experimental work has been done with this material which suggests that it is similar in value to equivalent solid fertilizers. Claims that a single heavy dressing injected in spring would carry the grass crop right through the season have not been confirmed in later work, as this showed a falling off in yield later in the summer similar to that when liquefied ammonia was used. This material seems to have the disadvantage of a relatively low concentration of nitrogen while still needing to be injected, which makes it less attractive than either liquefied ammonia or non-pressure solutions.

Nitrogen solutions

Limited quantities of low pressure solutions which are mixtures of ammonia with ammonium nitrate and urea are available, but these suffer in the same way as aqueous ammonia in having to be injected into the soil and are also slightly more expensive per unit of nitrogen.

Non-pressure solutions which contain only ammonium nitrate and urea and which can be applied to the surface of the soil or to growing crops, are widely used in the U.S.A. and can contain up to 32 per cent nitrogen. They are more expensive than ammonia but can be applied with much simpler equipment and are more concentrated than most of the solid nitrogenous fertilizers at present in use.

Experiments in south-east England showed that there was sometimes leaf scorch when such solutions were used for top-dressing winter wheat in late April, while on the calcareous soils used, the liquid was often not quite so efficient as solid ammonium nitrate. A parallel series of trials in Yorkshire gave little or no scorching of the crop but similar yield results. This is in line with other experience using solid urea which can, under some conditions, be rapidly hydrolyzed to ammonium carbonates which are unstable and readily lose ammonia to the atmosphere. Experience in Britain with other crops is more limited but suggests little difference in the effectiveness of the solutions and solid fertilizers.

Liquid compound fertilizers

These are made by mixing solutions of ammonium phosphates (mono-ammonium and di-ammonium phosphate) with additional nitrogen as urea/ammonium nitrate solution and potash as solid muriate to give the required analysis. The chemical compounds they contain are therefore similar to those found in solid fertilizers and as might be expected, they

behave in a similar way when applied to the soil. Some experimental work has been done with them but in view of the basic chemical similarity to solids and the identical early results from the two forms, it has not been considered necessary to continue it.

The use of fertilizers in liquid form has both advantages and disadvantages by comparison with solids. The main advantages are ease of handling, evenness of application and the possibility of placement, while the disadvantages are low concentration, the need for tanks for storage and the somewhat high unit cost.

Ease of handling

Liquids can easily be moved by pumping either from storage at the manufacturing plant to the transporting tanker or from the latter to the application machinery. Solids usually have to be moved by hand in sacks at some stage and possibly at several.

Even application

Liquids are pumped out through nozzles or jets and even application by this means can easily be achieved. Uneven application of solids, especially if spinners are used, is common.

Placement

Work at Leeds University has shown the advantages in dry seasons of deep placement which can more readily be done with pumped liquids than with solids using presently available equipment.

Low concentration

Because of the low solubility of some of the possible reaction products in a liquid compound the maximum concentration is a total (nitrogen plus phosphate plus potash) of about 30 units per cwt whereas totals of 45–50 units can be obtained with solids. This means that perhaps 50 per cent more of the liquid must be used to give a similar rate of application of nutrients.

Storage tanks

Solids in plastic bags can be stored in simple existing buildings or even in the open for short periods while, for liquids, tanks are essential either on the farm or elsewhere. This means that capital has to be employed which must ultimately add to the cost of the product.

Cost

Liquids may cost more than solids because of the need for purer chemicals to prevent sludge formation from precipitation of impurities with resulting blocked nozzles, etc. The need for tanks for storage also increases costs but, on the other hand, the plant needed to manufacture liquids is much simpler and very much less costly than that required for concentrated granular solids.

The decision as to whether liquids or solids should be used will depend very largely on organization and management factors on the farm. Much of the liquid used is applied by contractors with a resulting saving in the use of farm manpower but there may be difficulties in getting the work done when required. There is no point in saving the time of farm workers unless they

can be gainfully employed elsewhere. Each farmer must obviously work out for himself which method is best in the light of his own circumstances.

Future developments

These appear to lie mainly in the development of more concentrated liquid compounds. At present, using ammonium ortho-phosphate solution, the maximum concentration of a 1:1:1 type compound which can be produced is one of composition 7:7:7, i.e., 7 per cent N, 7 per cent P_2O_5, 7 per cent K20. Some increase in concentration can be achieved by using super-phosphoric acid instead of the normal ortho-phosphoric acid in manufacture and clear solutions of composition 9:9:9 are available. To produce more concentrated mixes clear solutions have to be replaced by suspensions. In these finely divided crystals of solid fertilizer are held in suspension in a fertilizer solution with the aid of 2–3 per cent of the clay attapulgite. Stable suspensions, which behave like liquids, are being used in the U.S.A., where they have been developed by workers of the Tennessee Valley Authority, with composition 15:15:15 which is as high as can be obtained in solid form at present. Such suspensions may well be developed here and remove at least one of the disadvantages attending the use of liquids, that of low concentration.

Liquid fertilizers appear to have a definite place in British agriculture and their use may well increase in the coming years.

The author of this article, **J. Webber, B.Sc.(Agric.)**, is the son of a Devon farmer and did his training at Seale-Hayne Agricultural College, Newton Abbot. He then became assistant to the Provincial Soil Chemist at Leeds University before joining the N.A.A.S. on its inception in 1946, and he has been the Regional Soil Scientist at Leeds since 1952. During 1967 he visited the U.S.A. to study liquid fertilizers and anhydrous ammonia.

Ministry of Agriculture, Fisheries and Food

Technical Bulletin No. 17

Bacteriological Techniques for Dairy Purposes

THE methods described in this technical bulletin were compiled by advisory bacteriologists of the National Agricultural Advisory Service in conjunction with bacteriologists of the National Institute for Research in Dairying, Shinfield. They were issued originally as provisional techniques and after continuous use in N.A.A.S. laboratories over the past twenty years are now being issued as standard techniques.

The bulletin contains a useful historical introduction, sections giving the technical details for preparing glassware and bacteriological media and standard methods for the examination of raw and pasteurized milk, milk products and rinses and swabs of dairy equipment and farm water supplies. The appendices contain recommendations for the application of bacteriological advisory work in relation to modern methods of milk production.

Bacteriologists, dairy advisers, lecturers and students will find the recommendations and detailed information on proven bacteriological methods invaluable for application in connection with advisory and quality control work on the farm and in the creamery.

Copies of this Bulletin may be obtained from Her Majesty's Stationery Office, Government Bookshops (addresses on page 556) or through any bookseller, price 13*s.* 6*d.* (*by post* 14*s.* 3*d.*).

17. North East Glamorgan

Brynmor Rees

NORTH EAST Glamorgan to many beyond its borders, suggests coal mines and chimney stacks, grey barren ash tips and the satanic glare of furnaces in the night sky. These are there, of course, but behind this grimy facade there thrives a virile agriculture.

Situated between the Vale of Glamorgan and Brecknock Beacons, it is bounded on the east by the River Rhymney, which it shares with Monmouth, on the north by the limestone hills of South Breconshire, on the west by the River Ely and on the south by Caerphilly Mountain and the picturesque Cefn Mably Castle four miles west of Newport.

Traversing the area are the highly industrialized valleys of the Rhymney, Taff, Rhondda and Ely, part of no fewer than eight Parliamentary constituencies, where farming and, in particular, shepherding is accompanied by hazards associated with farming behind the 'urban curtain', namely, trespass and killer dogs.

Compensating factors include a ready market for farm produce, casual labour for harvesting and assistance in pest destruction.

It is an area of contrasts—soils ranging from neutral to extremely acid; altitudes of between 50 and 2,000 ft; rainfall of 40 to over 90 inches; first-class stock and arable farms contrast with small, marginal hill farms and mountain sheep runs. Seasonality of plant growth varies from ten months in the south to six months in parts of the northern uplands.

The district is a rich field of study to the historians, sociologists and ethnologists, containing as it does distinct types of people in both rural areas and cosmopolitan valley towns.

Steeped in history are places like Merthyr Tydfil—the traditional home of iron manufacture (1540); Pontypridd, the 'Charing Cross' of the uplands; Caerphilly, whose castle is second in size only to Windsor; Nantgarw, famous for porcelain; Llantrisant, now also a home of the Royal Mint and, of course, the great valley tradition in the world of culture, music, drama and sport.

Scenically, the marvellous array of hills have a panoramic beauty and charm of their own; parklands, deep valleys with torrents of swift flowing water and waterfalls are all still to be enjoyed despite changes caused by industrial development.

Geologically, formations of Triassic, Carboniferous and Magnesium limestone along the southern boundary give rise to soils amenable to crop production, old red sandstone to first-class arable and vegetable culture, with coal measures, representing two-thirds of the district, forming the uplands.

Geographically, climatically and as regards farm types, the district divides itself into upland and lowland. The lowlands around Cefn Mably, home of some of Britain's tallest cedars, are devoted to mixed farming, dairying and intensive market gardening. Dairy herds are Friesian and, whilst pedigree beef herds are common, extensive use is made of crossbred animals in multiple suckled herds. In the case of sheep, the choice of breed is determined by the system of farming practised; Suffolk, Dorset Horn and Welsh Half-breds are popular.

In the transition from lowland to the coal measure uplands, changes are gradual with some of the better farms being at 1,000 feet. Here, land rises to 2,000 ft, rainfall from south to north by one inch per mile, soils in the unimproved state become increasingly deficient in lime and herbage progressively poorer. Tillage is designed to provide winter fodder crops and to maintain quality in grazing and hayed swards. Cash crops, potatoes and crucifers, for which there is a good local demand, are widely distributed, leaving a small cereal acreage confined to the drier drift soils and where facilities for combining and storage are adequate.

Livestock rearing with single or multiple suckled herds take pride of place, with dairying on many improved semi-upland farms. In the walled country above Nelson the pure-bred Welsh and Beulah sheep reign supreme; bred for maximum hardiness, size is influenced by contour of land and by extent of improved grazings. The traditional practice of 'tacking' ewe lambs is changing because of cost, scarcity of suitable 'tack' and improved methods of home wintering.

Nelson is the central livestock market, with Newport, Abergavenny, Bridgend and Cowbridge markets within a short distance of the district. Livestock is also traded by way of draft sheep sales, a weaner group, and a quality cattle association. In addition, a large number of store stock is destined via the Severn Bridge to feedlots in Southern England.

Other important features in the agricultural-industrial scene include a large daily supply of brewers grains, canteen and factory swill for stockfeeding, hay and seasonal grazing of municipally-owned sewage water meadows. Advantage is taken of power station flyash in the filling and eventual reseeding of quarries, iron ore pits, etc., and, in view of the high lime and phosphate status of this material, dressings of up to 40 tons per acre on damp acid soils are common.

By taking advantage of production grants, land reclamation continues on a large scale and, whilst it is often a potent aid to viability, it is partial compensation for loss of land for urban development and afforestation.

The northern hill area in the vicinity of Merthyr, mutilated during the industrial revolution of former days, has many a black monument of remembrance to that age and it is a real problem area. The loss of trees from the once heavily wooded slopes which provided the charcoal used in the manufacture of iron (one-third acre forest per ton of iron), followed by the deposition of colliery waste and the more recent extraction of opencast coal, are all factors that have destroyed much of the former beauty of the area.

Current legislation, aided by modern methods of land restoration, should, over the next decade, transform this area and again establish useful grassland.

With extremes in climate, elevation, soils, farm systems and people, this area is indeed most fascinating.

The author, N. J. Sneesby of the Agricultural Land Service, Cambridge, discusses the provision of shelter against soil erosion in arable areas

Shelter against Soil Erosion

THE wind erosion of soils, or, as it is colloquially termed, 'blowing', has constituted for a number of years a serious, and some believe a growing, handicap to the arable farming of certain soils. In particular, the soils affected are the fenland peats, or 'black land', and the light sands and sandy loams. This agricultural problem is not confined to any one area of the country but it is in eastern England that it is most marked. Here are found the largest expanses of open arable country, including very substantial areas of the most vulnerable soils, and here, also, there is a concentration on the spring-sown root crops which require a reasonably fine seedbed for drilling. An area which allows a long and unbroken 'fetch' of wind, with soils cultivated to a condition where the surface is fine and dusty, is clearly going to be one of erosion hazard. Since the east of England is notable for long spells of dry, windy weather during the period of maximum exposure, say, between the end of March and mid-May, it is not necessary to seek further for an explanation of why this is in large measure a regional phenomenon. Despite this strong tendency towards localization, however, it is a national problem in so far as the black fens represent the country's richest soils, and the physical sweeping of the top layers of soil is assisting natural wastage in reducing the depth of organic material to reveal the underlying mineral deposits; where the peat overlies sand or coarse gravel, as is frequently the case, productivity is bound to drop substantially unless some means is found to prevent the factor of erosion from operating. In the case of the sand lands the national damage can be regarded as less significant, as these soils are relatively infertile and can produce reasonable yields only by the input of large amounts of fertilizer, the careful husbanding of the moisture content and, where necessary, the addition of water to the soil. On the other hand, the sand land farmer's livelihood is probably more affected than that of his fenland counterpart; since his margins are lower the importance of his root acreage—and it is the root crop that suffers the lasting effects of erosion—is greater than in the fertile fens, which in any event have the capability to produce fair yields from a second drilling.

Broadly, a 'blow' can be expected when the wind reaches an average speed of about 20 knots, particularly if the wind is a gusty one. Avoidance of gusts is a basic principle in protecting land; this, of course, is easier said than done,

since access to fields is a self-evident necessity, and this in itself is a gust-hazard, or at least a creator of scouring draughts. Soil blowing results usually from a wind in the westerly sector, but this embraces anything from south-west to north-west; clearly protection from a south-west wind with shelter erected or planted at right angles to such a direction is going to be quite valueless with a north-westerly. Moreover, there is no guarantee that strong winds will not come from the east, or even from the north; records show that severe erosion has been caused by gales from both quarters. This suggests that a complete network of shelter is the only guarantee of protection for soil and crops but this is costly in land, particularly if full shelter from the strongest gales is to be sought.

The effects of a 'blow' are numerous and sometimes spectacular. Fen drainage channels may be filled level with soil, seed and fertilizer, making it an urgent task to get them clear; seedling plants are twisted and bruised, rendering them particularly susceptible to subsequent frost damage; in farmhouses and buildings, fine dust chokes machinery and causes inconvenience in innumerable different ways. A growing crop may be so damaged as to necessitate the total or partial re-drilling of affected fields, and this can markedly affect the ultimate yields. In some soils or with a late 'blow', the farmer may be reduced to a catch crop or even to leaving the land idle through the summer.

A large number of remedies have been proposed, and many tried out on a substantial scale. While these remedies may have their place, either individually or in combination in a particular set of circumstances, the provision of natural shelter remains the most advocated method of erosion control despite such admitted drawbacks as the use of productive land, root competition, shade effect, harbourage of birds and pests and so on. It should be remembered that a good hedge can provide useful shelter against the occasional 'blow'. Before deciding to remove an existing hedge the farmer ought, therefore, seriously to consider the effect this might have on the problem of soil erosion should he be unfortunate enough to suffer a 'blow' in the future.

Whether the farmer is faced with the decision of retaining existing windbreaks or of providing additional natural shelter, he would be well advised first to consult the A.L.S. in order to obtain information on how existing shelter, perhaps in the form of hedges, can be better utilized to counteract the effects of a 'blow'. The A.L.S. can also give advice on ways of obtaining the maximum effect of shelter and the most suitable tree or hedge species to select for the particular purpose in mind. Information is also available about the best planting methods, after-management and grants for the establishment of shelter which may be payable under the Farm Improvement and other schemes.

The planting season extends from early October to late April. Any spell of open weather during this period would be a suitable time for planting but dry or frosty conditions should be avoided.

Early autumn is, therefore, a good time for farmers to consider, where there is a risk of soil blowing, whether hedge removal schemes will aggravate this risk, and also whether the likelihood of blowing could be reduced by planting additional natural shelter.

in brief

- **Plant breeder and the farmer**
- **Formula for quality silage**
- **Pigs on the increase**

Plant breeder and the farmer

In an age when new lamps are being exchanged for old with bewildering frequency, the work of those patient and indefatigable staff in research laboratories seldom hits the headlines. We are inclined to take it all very much for granted. Take the plant breeders, for instance, whose research programmes are drawn up to meet the need for their answers to be integrated into changing systems of farming and who must manipulate genes to give higher yields from fewer acres and resistance to disease organisms and pests which can themselves adapt to changing circumstances. The Annual Report of the Plant Breeding Institute, Cambridge, for 1966/67* makes salutary but fascinating reading. Faced with the build-up of cereal leaf diseases, urgent steps are being taken to introduce greater stability in cereal varieties by exploiting field resistance which is not specific to different races of fungi. In his general survey, the Director, Dr. G. D. H. Bell, does not necessarily go all the way with the view, often expressed, that it is dangerous to sow large acreages to a single variety such as Proctor or Cappelle-Desprez because of a breakdown of resistance to one or other of the fungal diseases. Both Proctor and Cappelle have been in cultivation for 15 years and their popularity, he says, is being lessened not by a high incidence of disease but by the promise of new varieties with better field performance. Although some of the new varieties do have resistance to a wider range of races of mildew or yellow rust their yield potential is higher, regardless of this factor, than that of the older ones. New cereal varieties under trial in different parts of the country are all being closely watched for the occurrence of new races of powdery mildew, yellow rust, crown rust, brown rust and oat leaf spot, while leaf blotch of barley (*Rhynchosporium secalis*) is receiving special attention.

There is a re-awakening of interest in rotational farming and this is concentrating attention on the need for precisely defined experiments in the modern context, especially regarding different soil types and the effect of high level nitrogen dressings. Greater interest is being shown in break crops. Oats have done well in the last few years, but the cereal cyst eelworm may in some cases be a deterrent. Oil-seed rape is also under observation, although the commercial future of this crop is a matter for speculation. But the present work at Cambridge on the high yield potential of field beans is concentrating on the testing of F_1 hybrids for seed production to give the grower seed at a lower initial cost. The possibilities here are very interesting.

The repercussions of the expanding and now more exacting market for potatoes for crisping has brought additional demands on the plant breeder's skill. An urgent need exists for one or more varieties to replace earlier choices as Record replaced Bintje, and already selection for good crisping quality based on high dry matter and low reducing-sugar content has yielded many seedlings for bulking and further study.

*Price 7*s.* 6*d* from the Institute, Maris Lane, Trumpington, Cambridge.

In the long view the yield of all crops will have to be increased if, in the words of the Working Party of the A.R.C., 'Great Britain may require in 30 years' time at least twice the 1967 net output of home-grown food'. Farmers as well as plant breeders have a full part to play. Dr. Bell instances the case of grass, where acreage must be sacrificed to meet the expansion of certain arable crops. 'The necessary increased productivity', he says, 'will need to be achieved by a dramatic increase in yields and improvement in utilization, including conservation. Grass is the most glaring example in this country of a crop in which the varieties provided by the plant breeder are not being fully exploited by the user'.

Formula for quality silage

Good organization of labour and machinery and speed in cutting and ensiling the grass crop once the ear-emergence stage has been reached is the formula for silage of high feeding value. Where the labour force makes it possible (say, with a gang of three or four men) the grass should be cut and wilted to around 25 per cent dry matter before quick ensiling and immediate sealing, so providing for good fermentation when properly consolidated and eliminating the risk of effluent.

At a recent I.C.I. demonstration held on Dairy House Farm, Middlewich, Cheshire, where 3,000 tons of silage are normally made annually, the importance of the rate of working to get the highest value product, especially with first cuts, was emphasized by Mr. A. Walsh, the regional development manager. There are only about ten days, he said, in which to catch the crop before digestibility starts to fall off. For the second cut, the rate of ensiling is less important, since digestibility declines more slowly, and the bulk is lighter and more easily handled.

The particular system to be chosen will vary from farm to farm, depending on the availability of men and machines. High-output systems generally need specialized equipment, incurring heavy capital outlay, which is where machinery syndicates can prove so useful. On small farms, where the hauls are short, the recommendation was to use a 40 inch in-line forage harvester with a permanently attached trailer. As each load is gathered the whole train—tractor, forage harvester and trailer—travels to the silo, tips the load and returns for another. No time is wasted on hitching and unhitching the forage harvester and trailer, and the tractor driver need not leave his seat.

Pigs on the increase

A distinct renewal of confidence among pig farmers is apparent from this year's United Kingdom pig population figures. The national breeding herd has increased by 72,000 since June 1967, which in England and Wales is a rise of 8 per cent, in Scotland 18 per cent and in N. Ireland 6 per cent. The greater part of this recovery is seen to be in in-pig gilts—154,000 as compared with 137,000 twelve months ago, of which 125,000 compared with 108,000 are the respective figures for England and Wales. The total U.K. pig population is now running at 7,447,000 as opposed to 7,106,000 in June last year; the corresponding figures for England and Wales are 5,867,000 and 5,639,000. Classified by Ministry regions, the Eastern, South-West and South-East are, in that order, still the three major pig producing areas.

The present pattern is one of substantial increases in the average size of herds, notably in the South-East, East Midland and Eastern regions. 'Although small herds are disappearing rapidly', comments PIDA, 'herds on small farms continue to play an important role in the pig industry. In 1967 over a third of the total breeding herd in England and Wales were on holdings of under 50 acres'.

AGRIC

Books

Urea as a Protein Supplement. Edited by M. H. BRIGGS. Pergamon Press, 1967. £7.

The catch phrase 'Read all about it!' is surely justified for this excellent book. Twenty-six authorities from five continents have contributed between them four hundred and sixty pages. So skilfully has the work been planned and so carefully has it been carried out that every aspect has been covered with very little duplication of material.

Two features deserve special commendation. Firstly, there is the provision of very comprehensive bibliographies at the end of each chapter, amounting in all to many hundreds of references. Secondly, most of the chapters finish with a useful summary which draws attention to the outstanding points discussed.

Several chapters are devoted to the organisms which utilize urea, their occurrence in the rumen, and the factors which affect the utilization. There is also a chapter on the urea cycle of the ruminant. This is followed by a discussion of urea toxicity and its prevention.

Next, half-a-dozen chapters deal with application of urea to feeding various classes of ruminant: beef and dairy cattle, buffaloes, zebus and lambs. Guidance is also given on methods of feeding. The subject matter of these chapters may be well known to most readers but even so they will welcome having the information so compactly.

The later chapters answer some questions which are frequently asked. People wonder whether urea should be added to silage because they hear it has been done in the U.S.A. It becomes clear that the practice succeeds there because the crop used—maize or sorghum—is low in protein, and high in carbohydrate and dry matter. It would seem to be without value for grass silage, which in Britain, one would hope, has adequate protein already and is more likely to be deficient in starch equivalent. It might have a place in high, dry matter tower silage made from inferior fodder.

Another question asked is its value for non-ruminants. The short answer is that for the pig it is more likely to do harm than good; for poultry, where protein metabolism is even more active than in the pig, it has no ascertainable value although some other non-protein nitrogenous substances (e.g., di-ammonium citrate) may have a very limited beneficial effect. Even the human subject comes under discussion.

The book is well-produced with clear type, a good layout, and many tables and diagrams. There is a useful index, although some matters have not been included. There are a number of misprints but none were noticed which could mislead. It can be recommended without reservation to anyone desiring comprehensive information on this topical subject.

S.M.B.

Ahead of Their Time. A short history of the Farmers' Club 1842–1967. KEVIN FITZGERALD. William Heinemann, 1968. 42*s*.

This is a useful addition to the library shelves. The main title is not altogether appropriate for its reading gives rise to a constant feeling that so much is still of today. I was tempted to parody the popular song and suggest a different title 'It seems we sat and talked like this before'. That is not to say that no progress is being made but, nevertheless, the subjects discussed from the earliest days of the Club are not dissimilar to those of today. In that connection Appendix III is a most valuable part of the book. It gives an indication of the subjects considered to be of importance over the years and many of them crop up time and again.

The book is not easy to read but it is well worth the effort. In an age when general studies are being added to the curricula of places of further and higher education, the book should be recommended to others as well as agricultural students. It is a useful account of how agriculture has met changing economic and social conditions.

One senses an impish Irish humour in the way that much is made of the Club not getting involved in politics. Perhaps it does seem that we get much better results when bodies are strictly non-political. Clearly, the Club has done much for the country and British agriculture.

B.H.H.

Soils of the West Sussex Coastal Plain. (Soil Survey of Great Britain, Bulletin No. 3.)

This is a welcome addition to the publications of the Soil Survey of England and Wales. It deals with the relatively intensive area of the West Sussex Coastal Plain together with a narrow fringe of the South Downs. General physical features of the area are discussed and descriptions are given of the agriculture, horticulture and forestry, contrasting the coastal plains and the downs.

As in other memoirs, the principles used to classify the soils are described but it would be advantageous for readers to have some previous knowledge of nomenclature and techniques. Descriptions are given of the soils of the South Downs, the coastal plain, the Eocene outcrop and of the alluvial valleys. The individual soils are discussed in detail and each chapter has a section relating the soils to land use. These sections describe the virtues and limitations of each soil series and should prove most useful to farmers and growers as well as to advisers. A provisional land capability classification such as that used in the memoir *The Soils and Land Use of the Church Stretton District of Shropshire* might have been helpful. Detailed physical and chemical descriptions are given which should be very useful to all those who study soil.

The presentation of soil maps on the basis of 2½ in. to 1 mile allows greater detail than the 1 in. to 1 mile, normally used by the soil survey; this should prove of great value.

Altogether, a very worthwhile publication which can be purchased from the Librarian, Rothamsted Experimental Station, Harpenden, Herts. Price 40*s*. (20*s*. without maps).

L.J.H.

Weed Control Handbook. (5th Edition). Vol. 1. Principles. Edited by J. D. FRYER and S. A. EVANS. Blackwell Scientific Publications. 65*s*.

Probably no science has made such rapid progress since the war as that of weed control. The first edition of this handbook was published in 1958 and new editions have appeared regularly at two-year intervals; the appearance of these volumes was awaited with keen anticipation by both farmers and advisers. The handbook has grown steadily in size to cope with the mass of new information which became available year by year.

The 1968 edition is now presented in two parts and Volume 1 is given the title of *Principles* and discusses, in detail, the very wide range of methods now available for the control of weeds. There is hardly any aspect of the subject which is not discussed. In addition to weed control on the farm, it also deals with the subject in forests and forest nurseries, in turf and sports surfaces, in land not used for crops and also aquatic weed control. The list of contributors to each chapter is in itself a guarantee of authenticity.

The Editors are to be congratulated on achieving such a high standard of uniformity in a volume prepared by so many authors. This book is a veritable mine of information on the subject. It cannot be too highly recommended to 'all who are interested in the practical and scientific aspects of the subject' to quote from the preface by Mr. W. E. Jones.

R.E.

Weed Control Handbook. (5th Edition). Vol. II. Recommendations. Edited by J. D. FRYER and S. A. EVANS. Blackwell Scientific Publications, 1968. 27*s*. 6*d*.

This volume entitled *Recommendations* should be very useful to anyone who is faced with the problem of controlling weeds. Details are given of the herbicides to be used for weeds in practically all agricultural and horticultural crops and the best time to use them. There is a series of tables giving the susceptibility of most of the more common weeds to different herbicides.

This handbook will be of great value to farmers, growers and their advisers who wish to control the weeds in their crops. The Weed Control Council hopes that Volume I on *Principles* will need only occasional revision whilst Volume II will be revised regularly, to take account of new developments.

This handbook supplies a ready answer to those who often complain about the length of time it takes to get the results of research embodied into farm practice. The latest information on the subject of weed control is presented with the minimum of delay and in a form in which it can be readily adopted by the farmer. Where there is insufficient evidence to make a firm recommendation, the advice is marked 'for information'.

There is a comprehensive index and an addendum of three pages to ensure it is up to date.

In all, it is a most useful and informative publication.

R.E.

Partridge Rearing, Booklet 4. Eley Game Advisory Station, 1968. 3*s*.

This is another booklet in the series issued by an Advisory Station whose publications are always received with considerable interest and respect.

Old ways of farming with its occasional rootbreaks in the rotation, later grass cutting and smaller fields with more hedgerows, suited game conservation. Agricultural methods are dramatically changed. No longer can we be sure that nesting hens and their chicks will be out of the way before grass is cut. Indeed, the early grass cutting is now the cause of much slaughter.

Modern methods of husbandry complicate the traditionally difficult job of partridge rearing and this probably explains one's first impression from reading this pamphlet, that the techniques of rearing are becoming very specialized. The partridge was always difficult to deal with; as the introduction to the book says, it is quarrelsome, prone to disease, erratic in egg production, nervous and difficult to handle. Add to this that modern agriculture is out of harmony with the old rhythm of game husbandry and one appreciates both the problems involved; also the need to understand the business of rearing before one embarks upon it.

This booklet is a revised version of one of the earliest and most popular in the series and all concerned with partridge rearing will find much of value in it.

R.G.A.L.

Agricultural Chemicals Approval Scheme

List of Approved Products, 1968

In the list of additions published in the October, 1968 issue of *Agriculture* (page 508), the headings INSECTICIDES and HERBICIDES were inserted in error and should be disregarded.

ACKNOWLEDGMENT OF PHOTOGRAPHS

Front cover and Pp. 522 and 525 Forestry Commission. P.509 *Farmers Weekly*. P.510 *Farmer and Stockbreeder*. Pp. 515 and 517 A. W. Prowel. P.532 Plant Protection Ltd., P.542 M. Butterwick and E. N. Rolfe.

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OFFICIAL APPOINTMENTS

General agriculturists and agricultural specialists of many kinds are frequently required in the effort to match the large demand from the developing countries. The vacancies advertised below are a selection from the many openings which exist now. While they are being filled, other vacancies are arising.

Salaries within the ranges quoted are assessed on qualifications and experience; and the terms of most appointments include free or subsidised accommodation, education grants, family passages, good leave on full pay, etc. A contributory pension scheme is available in certain circumstances.

Most appointments are limited to nationals of the United Kingdom or the Republic of Ireland who are normally resident in those countries.

ETHIOPIA

Lecturers in Agricultural Extension — *RC 213/58/012*

Duties: To teach in the classroom and particularly through practical field projects by establishing demonstration areas incorporating nearby farming communities.

Qualifications: A degree in agriculture with considerable experience in agricultural extension work in developing countries, preferably in Africa. Salary £1,500—£2,700 p.a. subject to British income tax, plus a variable non-taxable overseas allowance of £750—£1,580 p.a. according to marital status. Contract 3 years.

FIJI

(1) Agricultural Engineer — *RC 213/62/011*

Duties: To design and advise on small irrigation schemes for gravity and sprinkler irrigation schemes for rice, vegetables and fruit.

Qualifications: A degree in Agriculture or Horticulture with experience in all types of irrigation and construction required in small schemes. Age limits 25–45 years.

(2) Soil Conservation Officer — *RC 213/62/07*

Duties: Supervision and maintenance of technical standards in soil conservation work, by liaison with District Agricultural Officers who administer all soil conservation extension, machinery and field staff. Arrange in-service training in soil conservation for field staff. Prepare lectures and examinations for the soil conservation course at the Fiji School of Agriculture. Assist in preparation of soil conservation publicity. Advise on soil conservation matters through the Director of Agriculture or through the Land Conservation Board.

Qualifications: A degree in Agriculture or Science with experience in practical soil conservation. Experience in tropical agriculture is desirable.

Salaries: £ Fijian 1,092—2,181 (£ Sterling 1,045—2,087) p.a. An inducement allowance normally tax free, in the range of £ Sterling 508—829 p.a. is also payable direct to an officer's home bank account. Gratuity 25%. Contracts 30–36 months.

MALAWI

(1) Agricultural Research Officer (Rice Agronomist) — *RC 319/134/016*

Duties: To draw up and execute a programme investigating all aspects of rice agronomy under rain fed and irrigated conditions.

Qualifications: A degree in Agriculture and experience in rice agronomy under tropical conditions. Salary £1,485—£2,600 p.a.

(2) Landscape Architect — *RC 319/134/06*

Duties: To design and supervise the construction of landscape schemes, including Government official residences, public buildings, parks and botanical gardens.

OFFICIAL APPOINTMENTS

MALAWI—*cont.*

Qualifications: Candidates must be A.I.L.A. or have an equivalent qualification with experience in landscape architectural practice. Salary £748—£1,782 p.a. plus an inducement allowance in the range of £427—£818 p.a.

The above appointments also carry, in addition, a supplement of £100 p.a. payable direct to the officer's bank account outside Malawi and Rhodesia. Tax-free gratuity 15%—25%. Contracts 2–3 years.

SWAZILAND

Irrigation Officer

RC 213/169/08

Duties: To undertake the survey, planning and layout of small irrigation schemes involving gravity and sprinkler systems, to advise and assist extension staff and the farming community on installation and operation of irrigation schemes, to train subordinate staff in survey, water measurement, crop water requirements and distribution systems, and to lecture diploma and certificate level students at the agricultural college, if required.

Qualifications: A B.Sc. (Agric.) or B.Sc. (Agric. Engineering) or Diploma in Agriculture with long experience of irrigation engineering. Salary Rand 2,256—4,800 (£ Sterling 1,316—2,800) p.a. plus an inducement allowance in the range of £ Sterling 156—372 p.a. Gratuity 25% of basic salary and inducement allowance. Contract 3 years.

UGANDA

Principal Senior Research Officer

RC 213/183/05

Duties: To take charge of a small section of scientists investigating the breeding and selection of food crops.

Qualifications and Terms: At least a second class honours degree in Botany or Agricultural Botany with postgraduate training in plant breeding and overseas experience.

Basic Salary E.A. Shillings 36,780—43,500 (£ Sterling 2,145—2,537) p.a. In addition, an allowance, free of Uganda Income Tax, in the range of £ Sterling 960—1,010 p.a. will be paid by the British Government, on behalf of the Uganda Government, direct to an officer's bank account in Uganda. 25% gratuity. Contract 21–27 months.

ZAMBIA

(1) Agronomists

RC 213/132/07

Duties: To work at and possibly take charge of a regional experiment station and be responsible for the definition of agronomic and animal husbandry programmes of applied research and to carry out applied investigational work on a regional basis.

Qualifications: A degree in Natural Science with postgraduate agricultural training, preferably with experience in field experiment work in the tropics.

Salary Kwacha 1,944—4,344 (£ Sterling 1,134—2,534) p.a.

(2) Planning Officers

RC 213/132/05

Duties: To take charge of field planning teams and to be responsible for regional conservation planning on a catchment and/or settlement plan basis.

Qualifications: a degree in Agriculture or Natural Science preferably with relevant post-graduate training and/or experience.

Salary Kwacha 1,944—4,464 (£ Sterling 1,134—2,604) p.a.

In addition to the above salaries, an inducement allowance in the range of £ Sterling 243—429 p.a. is also payable plus a supplement ranging from £ Sterling 233—291 p.a. (payable direct to an officer's bank account outside Zambia). 25% gratuity. Supplement and gratuity are both free of local income tax. Contracts 3 years.

If you wish to apply for any of these appointments, or you are interested generally in an appointment overseas, please write giving your full name, age and brief particulars of your professional qualifications and experience to the:

Appointments Officer
MINISTRY OF OVERSEAS DEVELOPMENT
Room 324a, Eland House, Stag Place,
London, S.W.1.

MINISTRY OF OVERSEAS DEVELOPMENT